THE

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ELECTRICAL REVIEW.

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THE

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LONDON COUNTY COUNCIL ELECTRIC SUPPLY BILL.

IT looks almost as though the rejection of this Bill, to which we referred briefly last week, marks the conclusion for some time, at least, of any attempts to establish in London a central system of bulk and power supply. For Parliament has now had before it the three possible alternatives of dealing with the matter.

In 1905 the proposal was to be carried out by private enterprise, and although this was endorsed by Committees of both Houses, and by the House of Commons upon the second reading, yet the supporters of municipalisation were enabled to "block" the measure and prevent it from becoming law before the close of the Session.

Next year, 1906, Parliament had before it a municipal scheme which proposed the establishment of a bulk undertaking by the County Council. This also was rejected, by a Committee consisting of six Liberal and Labour members out of a total of nine. The private Bills of the Administrative and London Companies, however, were not allowed to go to second reading, although their promoters were allowed, and even requested by the Government, to go to the expense of assisting the Committee to its conclusion upon the L.C.C. proposal.

In 1907, owing to the elections of March last, Parliament has had before it a modified County Council scheme embodying a proposal for the co-operation of municipal and private enterprise. This, too, Parliament in its wisdom has seen fit to reject. The total expense involved—over £150,000 in all—has been so great that it is unlikely that private promoters will be found to put forward further schemes which, however sound they may prove to be financially and technically, are rejected upon other grounds. The chairman of the Parliamentary Committee of the County Council, moreover, has stated that the promotion of another County Council Bill will be a sheer waste of the ratepayers' money, and it would thus appear as though a dead-lock had been reached.

Ever since this controversy started there has been a good deal of misunderstanding as to the double object with which the initial schemes were introduced. The Administrative Bill, and the County Councill Bill, which was modelled upon it, provided primarily for the establishment of a bulk supply system from which existing undertakings would have the option of purchasing any additional power which the extension of their businesses might render necessary in the future, in place of extending their existing stations. The second object of these Bills was to give a retail supply of power to large consumers in cases where, in the opinion of the Board of Trade, the existing undertakings could not supply them equally cheaply. This, however, is not the part of the business in which the money lay, and was, as a matter of fact, more in the nature of a safeguard for the consumer, who, without it, might have been deprived of any benefits which concentration produced by the retailing distributing authority itself retaining them.

The real commercial value of the whole proposal lay in the smaller capital outlay which was necessary to erect a large station, and to put down the necessary transmission mains from that station into London, as compared with the cost of extending the existing stations. The lower working cost of a large generating station, and the gradual unification of the various systems of supply, were undoubtedly advantages not to be lost sight of, but the chief advantage was capital economy and the chief business would have been bulk supply.

The price at which electric power is now being sold in London is so low that, in the majority of cases, the profit resulting therefrom is negligible. Thus, even if the existing power undertakings had lost the whole of their retail power business, we very much doubt whether they would have suffered financially. They would certainly have gained, or been able to gain, by bulk supply much greater advantages than they could possibly have lost from the competition for power. That this was so is pretty clearly proved by one rather remarkable phenomenon which passed unnoticed at the time, when it looked as if the Administrative Bill was going to pass, and when many of the existing companies made agreements with its promoters. There was just then a considerable amount of quiet buying of London electric lighting shares by believers in the principle of concentration, and even by some of those interested in the large scheme.

A better proof as to the advantages which the existing electric lighting undertakings in London would have derived from the establishment of a central system of this kind, whether by the Administrative Company or the County Council, could not be found. But this was not the only advantage. The establishment of a system on the lines then proposed with a tenure of 42, or possibly 50, years would have done a great deal towards giving the London companies that extension of life which they are seeking in their present Bill. Altogether, therefore, it seems, now that the proposal has not passed into being, somewhat of a pity in the interests of electrical London, that those responsible for the management of the existing undertakings have been unable to see all that they had to gain from such a system, until too late. Their, perhaps, not unnatural fears that the purchase of electricity in bulk, in place of further extensions to the generating machinery under their care, might have somewhat lessened the importance of their office, which, of course, had a good deal to do with their hostility, were, to say the least, exaggerated, if not indeed unfounded. The increase of business which the economies of purchase in bulk would inevitably have brought to them would have probably compensated to a large extent, if not entirely, for the loss of, perhaps, the somewhat more interesting business of purchasing and running generating machinery, for the agreements which the London companies made with the Administrative Company in July, 1906, and which were appended to that Bill, clearly show that they had fully protected themselves; but they were entered into too late to allow of the Bill being passed.

But although those who have found the money for London's electrical enterprises may have lost somewhat by the failure to establish a central system of electrical generation, in the profits of which they were offered both a direct and an indirect share, a far greater loss has been suffered by the small user of electricity and by those engaged in the manufacture and sale of electrical apparatus. Whatever effect the proposed scheme would have had upon the existing undertakings, there is not the slightest doubt that it would have led to an enormous increase in the use of electricity and electrical apparatus in the Metropolis. Just as the fact of many millions of money having been sunk in providing London with additional transportation facilities has already led to a great increase in the amount of travelling done, so in the same way the fact that a body of financiers were willing to sink five or six millions in supplying London with cheap electricity must inevitably have led to an enormous increase in its use. This is, of course, altogether independent of the profit which might or might not have been derived from such a scheme. That is a matter on which the financiers must be left to take care of themselves. That the small electrical contractor and power user have for many years to come lost a golden opportunity will be realised more and more as time goes on, for it must be obvious to anyone who has taken the time to study the actual cost of electricity production in London to-day, that a continuance of the present low prices for power is not to be expected. Already they have had a noticeable effect upon the returns of some of the West-end companies, and, as soon as power consumption reaches a figure approaching the light consumption, power prices will in all probability be raised in exactly the same way as it has been found necessary by the transportation companies to raise their prices to the travelling public.

Depreciation. A CHARTERED accountant lecturing to students said that no one was bold enough to lay down fixed rates at which depreciation ought to be charged under all conditions, but that considerable diversity of opinion existed among experts, as no two cases were exactly alike.

That is true enough, but it is not possible or even desirable to attempt to put every undertaking of the same general nature, such, for instance, as an electrical supply or a tramway undertaking, on its own special and particular basis with regard to depreciation. Taken as a whole one English tramway is very like another, and the average lives of the components of the power house, of the track, cars, and overhead line can be taken without much probability of error to be the actual lives of the components of any one system. Moreover, in order to determine the divergence of plant under special conditions from the average life figure, it would be necessary to prophesy after the event, which is an unsatisfactory financial procedure. Both in England and in America what is wanted is the definite and continued practical application of some reasonably probable approximation to the average depreciation of tangible assets. Papers on the subject we do not lack, but practice lags sadly behind precept. Nobody can outstrip for long the Nemesis of depreciation, and least of all is he likely to escape who imitates the tactics of the ostrich in avoiding observation.

If provision for the wasting of material, representing capital, is not made willingly, the market will correct the omission sooner or later in as unpleasant a way as any debt collector employs.

The lecturer pointed out the fallacy of viewing the depreciation account as a loss similar to a reserve against bad debts, and explained that it does not involve taking money out of the business, and he proceeded to show that, during the first year's life of new plant, it is often inadvisable to make any charge against depreciation; while it is neither customary nor practicable, nor necessary to earmark earnings arising from what he called permanent property, such as piers, docks, railway tracks, telegraph lines, &c.

The reason for this seeming contradiction of statements is that all such works have, of necessity, to be maintained continually in perfect order out of revenue, and unless absolutely new work, which involves extended earning capacity, is done, new capital is not to be created. It should be an elementary proposition that doubling a railroad or tramway track is on an entirely different footing to renewing the rails, even with a more expensive pattern, or replacing wood with steel poles. In other words, wastage, wear and obsolescence must be met out of current or accumulated revenue, but increased productive power may be created out of new liabilities.

Copper. THE market is still in a very sensitive condition, with more tendency to decline (in sympathy with securities generally) than to rise. The influence which keeps copper from steadying down to a reasonable hard price is that of the consumer's demand which has yet to be satisfied. Forced sales by speculators unable any longer to carry their stock are soon taken advantage of, and therefore the sharp drops occasioned by the putting of large quantities on the market are speedily checked.

Stocks have not increased, and do not seem inclined to begin to do so; these returns, having naturally a considerable influence on the market, require close attention on the part of miners to prevent dropping the stock to Consols prices. Curiously enough, there is generally a drop in price at the end of the month.

Birthday Honours.

The Electrical Review will but voice the sentiments of a very wide circle of admirers in the Postal Telegraph and Telephone Service, of members of the Institution of Electrical Engineers, and indeed of the electrical profession generally, in expressing hearty congratulations to Mr. John Gavey, C.B., late engineer-in-chief to the G.P.O. upon the honour of Knighthood which has been conferred upon him by the King in the list of Birthday Honours just announced. There are occasions when the public wonders why honours fall to certain men, but this is one of the cases where not only is the voice of the critic silent, but congratulation is heartily and unanimously accorded. Seldom has honour in the public service been more deservingly granted than in the case of Sir John Gavey. Of less direct electrical interest is the baronetcy conferred upon Sir Charles Scotter, chairman of the L. and S.W. Railway and the now absorbed Waterloo and City electric tube railway, and also chairman of a committee which is at present sitting to inquire into the working of Irish railways. Mr. Walter Scott, who likewise becomes a baronet, was associated with the contracting side of an early London tube railway. Prof. E. R. Lankester, LL.D., F.R.S., last year's president of the British Association, is appointed an ordinary member of the Civil Division of the Second Class of the Order of the Bath; and Dr. J. A. Ewing, F.R.S., is made an ordinary member of the Military Division of the Third Class.

The Wireless Telegraph Convention.

The Committee which has been considering the Convention which was signed at Berlin last November, has "agreed" to report in favour of its ratification—if a majority of 5 to 4 can be called agreement. The report states that it will be advantageous to national and public interests to adhere to the Convention, and that it would be seriously detrimental to those interests to hold aloof; the Admiralty and War Office witnesses were unanimously of opinion that injury would be obviated and substantial advantages gained thereby; and in view of the material alterations in the Convention which were brought about by the British delegates, their influence at future conferences would be seriously weakened by the rejection of the present agreement. The narrowness of the majority is somewhat surprising, in the face of the weight of evidence that was given in favour of ratification, and it would be interesting to know on what grounds the minority based their adverse conclusions. However, it is now practically certain that this country will adhere to the Convention, and compulsory intercommunication will become an established fact next year.

The next thing, we suppose, will be the commencement of the litigation on the part of Marconi's Wireless Telegraph Co., Ltd., with a view to obtaining compensation for the alleged infringements of patents, that was hinted at by Mr. Marconi in his evidence before the Committee. How serious a view the company takes of the matter may be gathered from the fact that it has issued a circular to the shareholders, stating that the directors have decided to postpone the issue of their report and balance-sheet until the intentions of the Government are known.

Our opinions as to the mode in which the affairs of the company have been conducted are too well known to need repetition; but, nevertheless, we should feel disposed to sympathise with the shareholders were we not convinced that not only national interests, but also their own, will be advantaged under the new *régime*. By steady development on sound business lines, the company should now be able to make good the errors of the past, and, in view of the substantial lead that it has gained in ship-to-shore telegraphy, in spite of those errors, the chances are all in its favour.

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

(*Continued from Vol.* 60, *page* 1042.)

Cheap Power Supply by Municipalities.

Mr. C. E. C. Shawfield, in his paper on "Cheap Power Supply by Municipalities," submits a maxim—"Adjust the tariff to suit the competition, and the cost of production will adjust itself to the tariff."

We would admire the splendid tact possessed by any engineer who could inspire his committee with sufficient confidence to adopt such tactics, but we are curious to know whether or not a time limit would be specified to allow the cost of production to adjust itself to the tariff, and also a limit to the ratepayers' endurance in meeting the amount of deficit each year.

If it were possible to connect to the mains the full amount of load necessary to offer the minimum charge for supply simultaneously with the completion of a system or extension of any given system, undertakers would occupy a very fortunate position indeed in competing with other forms of motive power. But, unfortunately, in building up a load the process is gradual, and even in large industrial areas, before the acquisition of some 8,000 H.P. of motor connections (which is approximately equivalent to the 2,000-KW. installation in Mr. Shawfield's hypothetical case), considerable time must elapse, during which period consumers must pay in the price of energy, all charges upon dormant, in addition to revenue-earning capital, or the ratepayers must suffer.

The policy suggested is not new, as it has been vigorously applied in at least one borough within our knowledge during the past 12 or 18 months, and we must confess that we are awaiting the result with considerable interest.

We observe that Mr. Shawfield is opposed to the maximum demand system, and probably every engineer and consumer in the kingdom is in accord with him in some degree, but it is futile to oppose a system that is elementarily equitable unless an alternative system is offered, more advanced in methods of equity and application.

Mr. Shawfield does not do this, he advocates "a maximum price for motive power purposes not exceeding 1d. to any but the quite small consumers, further than this it would be necessary in the case of large works using over one million units per annum to offer a rate of ¾d. per unit or less, and in the case of still larger manufacturers, the rates quoted may fall as low as ½d. per unit." The assumption here is that the price per unit ought to be based upon the annual consumption of each manufacturer, and we presume by this method of calculation that a consumer using 1½ million units or thereabouts per annum, would be entitled to the ½d. rate. If we take a case where the maximum demand of an individual consumer is 1,000 KW. with eight hours per day working for 300 days per annum, and the average load-factor during running hours is 60 per cent. of maximum, a fairly liberal estimate, the annual consumption would be as follows, viz., $1{,}000 \times 8 \times 300 \times \frac{60}{100} = 1{,}440{,}000$ units; two such consumers, with identical working conditions would load up Mr. Shawfield's plant, and use 2,880,000 units, producing a revenue of £6,000 per annum. But we find, according to statement that the annual standing charges are £6,250, and the running costs ·21d. (both being calculated on an exceedingly low basis), equal to a further sum of £2,520, making a total of £8,770, and resulting in a loss of £2,770 per annum.

Clearly, Mr. Shawfield's alternative scheme to the maximum demand system is not the correct one.

Further, we cannot agree with Mr. Shawfield's estimate of capital expenditure necessary for the supply of 2,000-KW. of power. No provision is made for land upon which to erect the £6,000 building, and if we assume steam consumption at the rate of 25 lb. per kilowatt-hour, including radiation losses on boilers, piping, and engines, condensation

losses and pump consumption, and that the generators have to develop a 20 per cent. overload over the peak to give a 2,000 KW. supply on consumers' premises, we find the necessary boiler capacity is equal to 60,000 lb. per hour—say, two boilers, each of 30,000 lb. capacity, and are estimated at £2,350 each, including stokers, economisers superheaters and feed pumps. This price would be moderate for 20,000 lb. boilers, without feed pumps and economisers of any practical value, but the most important omission is that of stand-by plant, which would require at least £6,500 more expenditure if based on the estimate given. From the estimate for mains—viz., £10 per KW.—it would be possible only to supply the very large consumer, as, if the demand came from a multiplicity of consumers spread over a large area, the capital cost of mains would be three or four times that sum. Mr. Shawfield considers that the capital cost both of mains and plant for the very large consumer would be considerably reduced. The cost of mains would, of course, depend upon the distance of the consumers' premises from the generating station, and we think E.H.T. three-phase plant could not be laid down at a less cost than that estimated.

We certainly think, in considering running costs, that ordinary running conditions should be considered, and not contractors guaranteed results under test conditions, with allowances for contingent losses. What are the contingent losses allowed for by Mr. Shawfield? How many engineers can produce a balance-sheet for 12 months, showing an average coal consumption of 3¾ lb. per unit sold, with the coal having the calorific value of 12,000 B.T.U.?

In conclusion, Mr. Shawfield states that "there are cases in which specially low rates have been offered to large consumers, and it would be interesting to learn whether the basis on which these charges were determined is in any way allied to that advocated in this paper." We have no hesitation in stating that such is the case, and that Mr. Shawfield's maxim has already been adopted. We have yet to learn the ultimate financial result, but we fear disaster.

Costs of Electricity Supply.

If there is one point more than another which stands pre-eminent in the papers dealing with commercial matters which were presented to the members of the I.M.E.A., it is the emphatic manner in which the writers impressed upon the members the importance of accurate cost keeping.

Mr. H. R. Burnett, in introducing the subject of "The Costs of Electricity Supply and their Relation to Scales of Charging," frankly states that "many engineers do not accurately ascertain the costs of supply from the works of which they have charge," and "never in the history of electricity undertakings has it been of greater importance than at the present time that every engineer should possess a very intimate knowledge of the cost of supply from the particular works of which he has charge"; and not having possession of this information, "the scale or scales of charges" do not bear any relation to the cost of the undertaking.

Doubtless that is so, and also that charges are fixed in a haphazard fashion, but with satisfactory results, provided a surplus is shown at the end of the financial year. But, having made this statement, Mr. Burnett has not succeeded in proving the relationship of costs to charges, nor added in any way, any information which would enable the average engineer to reduce costs and place charges upon an equitable basis. Mr. Burnett, in recommending his system of works costs and record keeping, advances the statement that he has used it for the past eight years; probably other engineers have used a similar form much longer, but surely we might have expected some form a little more up-to-date, considering the huge strides made by the industry during the past two or three years. The system, although elementary, is good, and when carried further, answers a useful purpose in checking wasteful expenditure. We would suggest, as a supplement, a weekly record sheet divided into eight-hour shifts, with the running conditions of the plant more fully recorded, which would not only enable the engineer to immediately check wastages, but would indicate any fault in his generating system, and also show in which particular direction efforts should be made to induce additional load. Should the running cost per unit be higher during the second or power shift than during the third or lighting load shift, it is evident that steps should be taken to level up the load during the day, and so on. We cannot agree with Mr. Burnett that it is better to estimate the weekly cost of repairs; it is certainly correct to estimate at the commencement of each quarter a proportion of the annual estimate for repairs, but it is also correct to ascertain each week, if it is impracticable to do so daily, the exact amount spent, so that the engineer may know in ample time whether he is likely to have an adverse or favourable balance at the end of the quarter. By Mr. Burnett's own reasoning, "the actual cost during any particular week cannot reasonably be charged against the units generated that week." Quite so; neither can any other standing charge, yet Mr. Burnett includes wages. By what method of comparison can the wages in a lighting station during the summer months be compared with those during the winter months?

We must confess that we fail to grasp the significance of Curve No. 1 entitled "Quarterly Costs of Supply," and had hoped that fuller information would be forthcoming at the Convention. We take it that the standing charges, averaged quarterly, are as follows, viz.:—

Works costs	£398
Rates, &c., and management	359
Interest and sinking fund	1,485
	£2,242

And that coal, water and stores (repairs being averaged in above works costs) cost 0·6d., *irrespective of output*. This curve is plotted from a statement of gross receipts and expenditure (misnamed in the paper "Balance-sheet") for the four quarters of 1905-6. Are we to understand that the running cost was 0·6d. each quarter? Further on in the paper we are told that the costs during 1905-6 were £2,247 per quarter (not £2,242 as per curve) + 0·6d. per unit sold, and finally we gather that during the whole year named, the standing charges were 6·74d. per kilowatt per day of the lighting consumers' maximum demand, plus 0·6d. per unit running costs. This information (which surely did not require a curve to explain) is further used to graphically demonstrate to "committees and consumers," that the short-hour consumer is unprofitable, whilst the long-hour consumer pays more than his fair share of profit to the undertaking.

We are glad to find that the author is confident that "the method of ascertaining the costs of supply will be found to be sufficiently accurate for all practical purposes," but we are much afraid this eight year old, or more, method is not conducive to the present day development of electricity supply. The second portion of the paper is devoted to scales of charging, but the methods proposed are of a similar age to those for ascertaining the cost of supply, and contain nothing worthy of comment. The whole subject has been treated in these columns and elsewhere from time to time in a much more equitable manner.

Taking Thursday's proceedings of the I.M.E.A. Convention as a whole, we must confess to a sense of disappointment. It is unfair on the part of the Council to attract members from all parts of the country to a given centre, causing them to expend a considerable period of valuable time, ostensibly for the purpose of furthering the interests of the electrical industry, and to present matters of vital importance in a manner which can only be described as crude and inept.

Discussion.

The above papers were discussed together, Mr. J. F. C. Snell being the first speaker. He remarked that there was much in Mr. Shawfield's paper that he disagreed with. The correct fundamental basis of all systems of charging was the maximum demand system, and he considered that to "adjust the tariff to suit the competition" would lead to many bankruptcies. The question was, How were we going to meet the demand for low-priced units, with our original high capital expenditure? If "power" was only charged with its own new capital, "lighting" would, he considered, be unfairly penalised with the old capital, necessarily expended in pioneering work. As regards the author's distribution of plant,

his own experience was that with a large power supply a greater stand-by would be required, and he would, therefore, increase the plant suggested from 4,000 KW. to 5,000 KW., increasing the cost from £26,000 to £36,000, and decreasing the total capital per KW. from £13 to £12. As regards transmission expenditure, which the author estimated at £10 per KW. demanded, this was far too small, as also, he believed, was the estimate of 3·75 lb. of coal per KW. He would make the latter 4 lb. of coal on a 25 per cent. load factor, and increase the output to allow for distribution losses. With these modifications the total production costs became ·746d. instead of 635d., and this meant 1¼d. per cent. profit instead of 5 per cent. suggested by the author. Concluding his reference to Mr. Shawfield's paper, he suggested the necessity of varying the charges, according to the price of fuel. Turning to Mr. Burnett's paper, he urged that special consideration of tramway supply would lead to higher charges for traction. He quite agreed with a system of uniform initial charges with graduated discounts, but considered that the scale of charges ought to follow the curve of production costs shown in the author's diagram, and that large consumers ought not to pay as much as small ones. He concluded by urging that power supply charges should be based on a proper scientific system and not be too low.

Mr. S. L. Pearce considered that the two papers were opposed on fundamental principle, but he generally accepted Mr. Snell's argument, and did'nt think that Mr. Shawfield had brought forward any valid argument against accepted methods. He knew of many undertakings which were supplying power at less than 1d. per unit. If a private plant did'nt show a 40 to 50 per cent. load factor—and even if it did with a supply of over half a million units per annum, the public supply could compete. He considered that both papers payed too much attention in framing their charges to "profit"; the effect of a power load was to reduce costs, and so give an indirect profit. He did not think it was possible to fix any definite charges, as they varied according to circumstances, and he could'nt see how you could separate lighting and power supply costs, if the same distributing network were used. As regards the author's item of £10 per KW. for transmission, &c., he suggested that £16 was a more probable figure, especially with a mixed A.C. and D.C. supply. There were exceptional cases where fixed charges could be remitted; a power load might not pay in itself, but its general effect might improve the commercial prospects of the undertaking. The coal clause was in force in connection with Manchester power contracts. In regard to Mr. Burnett's paper, he did not agree with discounts for quantity irrespective of load factor.

Mr. A. M. Taylor, who dealt with Mr. Shawfield's paper, took the standpoint that his figures were, as a rule, low. He suggested that transmission costs might run as high as £40 or £50 per KW. demanded, including sub-stations; buildings might be £15 per KW.; turbines, condensers, switchgear he put at a lower figure, £7 3s. per KW.; boilers at £2 7s. per KW. he agreed with, but steam and exhaust piping would possibly cost three times the author's figure. On the whole, he believed the author's total of £13 per KW. should be nearer £25. He believed that, if every item of plant were included, the total would be some £30 per KW. of maximum demand.

Mr. S. Clegg (Lincoln) bore out the evidence as to the indirect influence of power supply, pointing out that a power load of some 600,000 units per annum supplied at ·9d per unit, had reduced his works costs from 1·07d. to ·75d. per unit, and enabled him to show a £3,000 profit in a revenue of £11,000, resulting in reduced charges to the lighting consumers.

Mr. W. W. Lackie (Glasgow) upheld the maximum demand system of charging, as it benefitted the right man; he felt sure that with power supply you would eventually throw in lighting as a by-product. In Glasgow, transmission costs were as high as £35 to £40 per KW., as against the author's £10; he agreed, however, with Mr. Shawfield's item for coal per KW., as in Glasgow they used under 4 lb. per KW.

Mr. E. E. Hoadley (Maidstone) said that in dealing with motor supply in Maidstone, he had ascertained from local factories what it cost per year for power, and had estimated from that a suitable tariff, which was a comparatively low one. Power supply, even on the limited scale possible in his area, had materially lowered the costs of production, and nearly 1,000 H.P. of motors were connected up now. The system of charging should take into account the horse-power demanded and include a coal clause. The overlapping of power and lighting loads in small stations was not an important matter; he thought it would be advantageous for small undertakings to follow to some extent Mr. Shawfield's suggestions on power supply.

Alderman West (Coventry) said that although they had adopted the maximum demand system, he now considered that it was necessary to take a broader view, and charge for electricity just like anything else on a uniform charge. He believed in starting initially with rates of charging suited to a considerable output, and in accompanying power supply with motor hire, if only in the first few years. In Coventry some 3 million units had been sold in the last year for power purposes, at slightly over 1d. per unit, and they had earned over £6,000 profit in that period.

Mr. Shawfield, in replying, pointed out that spare plant was covered by the turbines which had 100 per cent. overload capacity. He considered that if you want.d to sell electricity you must quote a suitable price or go out of business; the Sunderland prices were exceptional, and would hardly be obtained elsewhere. His estimate of coal per kilowatt was based on actual practice, and might, if he had accepted the maker's guarantee, have been much lower. He thought that Mr. Pearce really agreed that the cost of the production would adjust itself, judging from his remarks; the item of £10 per KW. was for special power mains, &c., to commence with, and all the figures were from tenders received. The only plant not included in the estimate was conveyors, which varied according to circumstances. He considered that Mr. Clegg and Alderman West had both, to some extent, confirmed his contentions as to cheap prices bringing a good load, which reduced costs and resulted in an indirect profit. In his own town he found that it was a case of dropping the maximum demand system of charging or of dropping power supply, and he dispensed with the former.

Mr. Burnett said that as to special consideration as to tramway supply, he considered the tramways should have any benefit derived from using special plant. He thought it advisable to adjust prices so that no adverse balances occurred, and agreed that the charge should be based on the horse-power demanded.

Mr. S. E. Fedden, in some concluding remarks, said he had been using 3½ lb. coal per unit sold for several years past. He agreed as to the value of hiring out motors as a means of introducing electric driving; he had now over 7,000 H.P. of motors on the mains, and last year sold over three million units for power at ·9d. per unit. He thought it was often advisable to supply initially at a loss, as this often led to excellent results later.

Report of the Council.

The twelfth annual report shows that the membership stands at 388, a slight decrease; committee members number 152, and chief engineers 166. The articles of association had been altered so that both these classes of members now hold office on Committee for two years, instead of one and three years respectively as formerly, and the financial year has been altered to end on March 31st.

The work of the Association on standardising carbon filament lamps has been absorbed in that of the Engineering Standards Committee, which, however, would not agree to make a reduction of the price for copies to members of the M.E.A. The proposal to organise a central information bureau, and to issue a periodical has been rejected after prolonged consideration. The Travelling Studentship has been awarded to Mr. McCourt (the only competitor) for his paper on "The Value of Photometry." The Council cordially approves of the new Wiring Rules of the I.E.E., in the preparation of which the Association took part.

Regarding the practice of the L.G.B. auditors of charging the wages of permanent employés engaged upon capital work to revenue, instead of to capital account, the Council has made repeated attempts to gain the ear of the President of the L.G.B., but without success, in spite of strong Parliamentary pressure upon the latter. It is understood that Mr. Burns emphatically declines to entertain any revision of the procedure, due, it is said, to the abuse of their powers by some local authorities. Another point on which the Council seeks relief from the L.G.B. is that of the payment of delegates' subscriptions and expenses at the I.M.E.A. meetings by the municipalities concerned.

The hon. secretary, Mr. Butler, has interviewed the Board of Trade on the subject of the Board's Electricity Bill, which is to be introduced as soon as there is a reasonable prospect of its becoming law.

An inquiry is on foot regarding the progress of electricity for street lighting. The hon. treasurer's report shows a balance of £309 19s. 3d. to be carried forward. The thanks of the Council to Mr. J. H. Rider, the late hon. treasurer, for his services to the Association are recorded. Mr. J. E. Edgcome is his successor in that post.

The general meeting of the association was held on June 27th, at which the report and accounts were submitted. The principal business was, of course, the election of a president, council, and executive for the ensuing year.

The following gentlemen were nominated and duly elected:—As President, Mr. H. Talbot, Nottingham; as Hon. Solicitor, Alderman Pearson, Bristol; as Hon. Treasurer, Mr. J. E. Edgcome, Kingston-on-Thames; and as Hon. Secretary, Mr. H. Faraday Proctor, Bristol; while as a result of the ballot, Mr. S. L. Pearce and Mr. W. W. Lackie were elected Senior and Junior Vice-Presidents respectively, Messrs. V. A. H. McCowen (Salford), T. P. Wilmshurst (Derby), G. Wilkinson (Harrogate), J. Christie (Brighton), H. Richardson (Dundee), A. A. Day (Bolton), C. E. C. Shawfield (Wolverhampton), and J. K. Brydges (Eastbourne) were elected engineer representatives on the Council, and Messrs. Ald. Wilkinson (Luton), Ald. J. P. Smith (Barrow), Ald. Dowson (Doncaster), Ald. Bruce (Sunderland), Councillor Sinclair (Swansea), and Ald. Sir John Turney (Nottingham) were elected as committee representatives on the Council.

Some discussion having taken place as to the advisability of selecting a place of meeting other than the Midlands, which has received the members twice in three years, it was decided to leave the place of meeting next year to the discretion of the new president.

During the course of the meeting a resolution was passed urging the Council to continue its efforts to secure a modification of the L.G.B. regulations as to the granting of loans, as far as they affect the salaries of officials engaged on new work; a resolution was also passed in favour of promoting the Board of Trade Electricity Bill in Parliament at the earliest opportunity, and both resolutions will be sent to all Municipal Councils, with a view to their bringing pressure to bear on their Parliamentary representatives.

It was further proposed that suggestions for papers for the next Convention should be given to the secretary, for consideration by the Council.

(To be continued.)

THE STELJES RELAY.

THIS relay, devised and patented by Mr. E. W. Steljes, whose name is well known in connection with type-printing telegraphy, consists of an arrangement which has for its object the provision of independently pivoted polarised tongues in combination with a single core, whereby three or more circuits can be opened and closed under the control of a main controlling circuit, or three or more other devices or sets of mechanism can be operated under the control of a main or controlling circuit.

In the arrangement shown by figs. 1 and 2, 1 is the core of an electromagnet, each end of which is made T-shape, so that it has two oppositely arranged polar projections 2, 3 at each end constituting

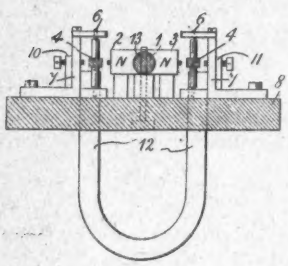


FIG. 1.

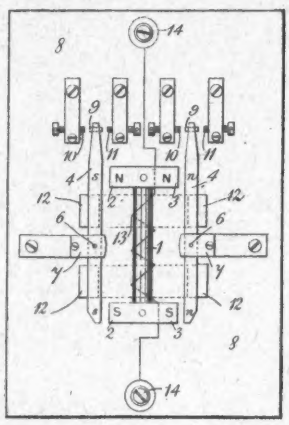


FIG. 2.

one pair 2, 2 or 3, 3 of lateral polar projections at each side of the electromagnet. Opposite each pair of lateral projections 2, 2 or 3, 3 is arranged a lever or tongue, 4, pivoted at 6 within a supporting bracket 7, mounted upon an insulating base 8, and carrying a movable contact 9 working between two fixed contacts 10, 11, so that the apparatus serves to control four circuits.

In this arrangement, the levers or tongues 4 are permanently polarised by a pair of bent permanent magnets 12 having their poles arranged in proximity to the pivoted portions of the tongues, so that the tongue on one side of the electromagnet becomes of opposite polarity to that on the other side of the same. 13 is the exciting coil for the core 1, being connected with the control circuit through the terminals 14. Normally, the tongues 4 are in the position shown, there being no completed circuit at any of the contacts 10 or 11. When, however, current flows in the coil 13 in one direction, the lateral projections 2, 3 at one end will be of different polarity to the projections 2, 3 at the other end, so that, if the

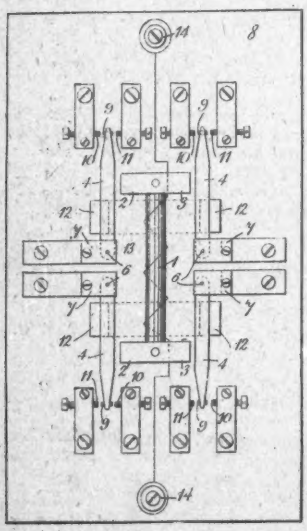


FIG. 3.

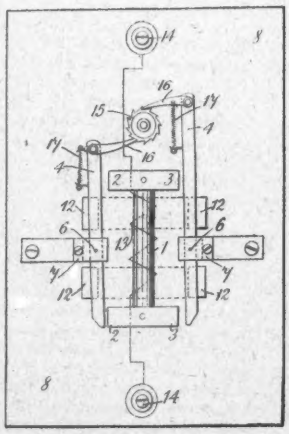


FIG. 4.

direction of all the fields be indicated by the conventional symbols N, S, N, S, the tongue 4 to the left in fig. 2 will be attracted at its upper end and repelled at its lower end, the reverse action taking place with the right-hand tongue 4. The result, therefore, will be to cause the upper ends of the tongues to be displaced to the right and to complete the circuits at the contacts 11. When the coil current reverses, the ends of the tongues, which were previously attracted, will be repelled, and *vice versâ*, so that the tongues will be displaced in the opposite direction to complete the circuits at contacts 10.

This arrangement, specially wound to 80Ω, has been recently tested by the Post Office for fast speed telegraphy, and, it is stated, with good results.

In the modified arrangement shown in fig. 3, a pair of separate lever arms or tongues 4 is arranged opposite each pair of lateral polar projections 2, 2, and 3, 3.

Fig. 4 shows a modification in which an arrangement, similar to that shown in fig. 1, can be utilised to operate any appropriate mechanism through the medium of a ratchet wheel 15, the requisite pawls 16 being pivoted to the ends of the tongues 4, and held in engagement with the teeth of the ratchet wheel by springs 17. This device has been adapted as a motor for such appliances as engine-room speed-recorders; switches on power circuits; electricity meters; train describers, &c. By its use the inventor has also been able to produce a tape and column-printing telegraph without driving weights or springs, which is at present working very satisfactorily at the Central News Offices.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

"Martyn's Patent" Motor-Car Terminal.

A very simple and reliable terminal for joining the high-tension cable to the sparking plug on a motor car, in such a manner that connection or disconnection can be made almost instantaneously has just recently been placed on the market by Messrs. S. W. MARTYN & Co., of 11, Pratt Street, Camden Town, London, N.W. On the spindle of the plug a little brass rod is screwed in place of the ordinary nuts, but, although this arrangement is very compact, it has the disadvantage that, owing to there being no standard for

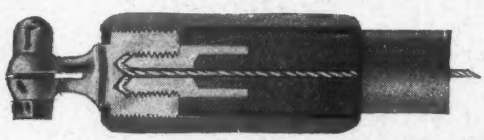


FIG. 1.

FIG. 2.

spindle thread, this part has to be specially screwed. As an alternative, and one to be recommended, an adapter can be used, which means that this little brass rod is riveted to a small steel plate with a hole in it for the spindle of the plug, to which it is clamped by the ordinary nuts, as in fig. 2. The main part of the terminal is made of brass, and at one end there is a round head through which there is a hole to fit the brass rod on the steel plate. The connection between this main part and the brass rod is very easily made and quite elastic, owing to there being a split in the round head. The other end of the main part is screwed externally to take a fibre sleeve, and screwed internally with a projecting cone at the end to take a hollow screw with a corresponding cone, between which cones the wires are held (fig. 1). The other end of this hollow screw is hexagon-shaped, with a wide slot right across it to take the heavy insulation of the cable, and thus relieve the wires of a mechanical strain which tends to break them, and which, under the old methods, was responsible for many electrical troubles.

The main features of this terminal are that the heavy insulation of the high-tension cable is mechanically supported, the wires are joined to the terminal in a very simple and reliable manner, and this terminal can be connected or disconnected almost instantaneously from the sparking plug. It is made in four standard sizes to take the ordinary diameters of high-tension cable. Further particulars can be obtained from the inventor, Mr. Sarsfield W. Martyn, at the above address.

Vertically-Arranged Motor-Generators.

The type of motor-generator shown in the accompanying figure owes its origin to the demand for a machine occupying the least possible floor space, to transform direct to alternating current or vice versa, with any desired pressure ratio. This problem was solved by the FELTEN AND GUILLEAUME-LAHMEYERWERKE A.-G., of Frankfort-on-Maine, by constructing a motor-generator, consisting of a direct-current shunt machine and a synchronous alternator, with a vertical shaft. As may be seen from the illustration, the square bed-plate is cast on to the shell of the lower machine, so that the floor space required for the whole set is extremely small.

This type of motor-generator may be used in all cases where there is not sufficient space to erect a machine with horizontal shaft. It is of particular value as a battery-charging machine for electromobiles in towns where the electric supply is alternating, or for industrial operations, &c. Another wide field of application for the machine is in the generation of alternating current for wireless telegraphy on warships and liners. The above-mentioned firm has recently supplied over 100 sets for this purpose.

The electric generators carried on ships are invariably of the direct-current type, and as a larger amount of power is required for long-distance wireless signalling than can conveniently be supplied by induction coils with either primary cells or accumulators, the necessary current must be generated by an alternator. The motor-generator here shown, fig. 3, consists of a direct-current shunt motor rated for a continuous output of 6 H.P., and an alternator having an output of 3·6 KW. with a power factor of 0·6. The supply pressure

FIG. 3.

of the motor is 107 volts, while the alternator develops a maximum voltage of 110, which may be reduced to any value down to 20 volts by means of a 28-step regulating resistance. The normal speed of the machine is 1,500 revolutions per minute, but it may be reduced to 1,390 or increased to 1,610 at will.

The current generated by the alternator is carried by connecting cables through the armature and commutator of the direct-current machine to two slip-rings, which are mounted above the commutator. Both bearings of the motor-generator are ball bearings, the top one serving both as a hanger and a guide bearing, while the lower is constructed simply as a guide bearing. The lubrication of the top bearing is effected through the oil supply opening seen in the illustration, the level of which is so arranged that the oil always covers the top series of balls (*i.e.*, the guiding portion of the bearing), but is prevented by a brass sleeve surrounding the shaft from leaking through to the armature windings, even if the vessel be rolling heavily.

By suitably dimensioning the slots, &c., the high-frequency oscillations produced in the transmitter circuit are prevented from extending to the machine windings. The machines are therefore particularly suited for wireless telegraph work.

Orling Receiver and Relay.

Continuing the development of his electro-capillary receiver for delicate telegraphic signals, MR. AXEL ORLING has patented the

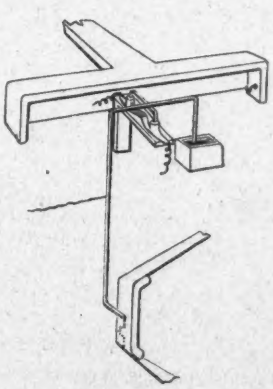


FIG. 4.

modification shown in the accompanying figures. Fig. 4 represents a siphon recorder, the siphon of which is actuated by a light bridge-piece with its ends resting on the surface of mercury in a capillary tube. The mercury column is interrupted by a drop of acidulated water, and in accordance with the well-known properties of this arrangement, the slightest difference of potential between the two bodies of mercury causes a displacement of the latter, which movement is communicated to the siphon and recorded in the usual way.

The second figure relates to the use of the apparatus as a relay; the moving arm which replaces the siphon tube is kept in vibration and plays over the surface of two metal plates separated by an

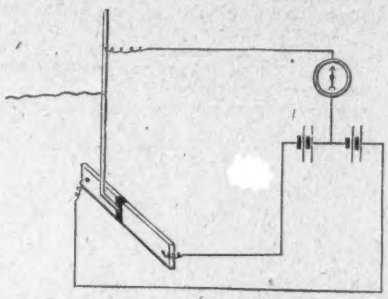


FIG. 5.

insulator. Movement of the arm to one side or the other closes local circuits which produce corresponding signals, either for direct re-transmission or for reading.

In the previous arrangement of Mr. Orling's device, the capillary tube containing the electrically vibrated liquid was itself mounted so as to move with the recording device, and its mass constituted a serious objection, which has been avoided in the present invention. The constriction at the part of the tube containing the dilute acid is also an improvement.

LEGAL.

HARPER & BROS. *v.* BIGGS & SONS.

IN the Chancery Division of the High Court of Justice, on Wednesday last week, Mr. Justice Swinfen Eady, in this case had before him a claim for damages for the infringement of plaintiffs' copyright in a book entitled "Elements of Electric Traction," registered on March 22nd, 1907, and for an injunction restraining the infringement of copyright. The plaintiffs' case was that under an agreement between them and Mr. L. W. Gant they became proprietors of the copyright in the book, and that defendants had infringed the copyright by printing and publishing, in their newspaper called the *Electrical Engineer*, long extracts from the book. The defence was that the extracts were published by way of review.

Mr. Scrutton, K.C., and Mr. Hart appeared for the plaintiffs Mr. Eve, K.C., and Mr. Meyer appeared for the defendants.

MR. SCRUTTON, in opening the case, said the review not merely told the public the nature of the book, but printed one chapter wholly verbatim without reference to the book. He submitted that to take important chapters in this way for the purpose of getting good copy for nothing was unjustifiable from the legal point of view.

MR. JOHN MURRAY, the well-known publisher, and others, gave evidence to the effect that the publication of such extracts as those complained of would interfere with the sale of a technical book.

MR. SLATER, manager of the plaintiffs, corroborated, and said that neither for payment nor by request would they have given permission to defendants to print ten pages straight off. He estimated the damage at over £25.

In cross-examination, WITNESS said that as soon as plaintiffs complained, the defendants undertook that nothing else should appear. His estimate of damage was based on the sale of a book on "Alternating Currents."

MR. EVE, K.C., for the defendants, said the question of damages seemed to be reduced to the difference between £5 and £25. It was the extravagant demand made by the plaintiffs that necessitated the bringing of the action. The review was intended to help the book, but owing to the exigencies of space it had appeared in an unfortunate form.

MR. C. H. W. BIGGS, the senior member of the defendant firm, said the book was sent for review. He wrote the review, and marked the portion of the book to be extracted, not knowing that the review would appear in instalments. He had a high opinion of the book, and extracted the portion about "brakes," in consequence of accidents to tramcars.

In cross-examination, WITNESS said he did not know how many copies of the paper were printed per week. He might have taken as much from other books for review purposes.

MR. W. BEAUMONT, M.I.C.E., author of several books and papers on engineering, expressed the opinion that the extracts published by the defendants would not interfere with the sale of the book, because they only gave an idea of the method of treatment, in which there was nothing new. The quotation was an unusually long one.

This concluded the evidence

Mr. Justice Swinfen Eady, in giving judgment, said it was admitted that the first article and extracts were fair, but complaint was made of subsequent extracts without any acknowledgment of the source. That far exceeded the fair and reasonable limits of review. In his opinion, the defendants had made a mistake, and had infringed the plaintiffs' copyright in four numbers of their paper. The defendants had paid £5 into Court, and he assessed the damages sustained by the plaintiffs at £15, or £10 in excess of that sum. The defendants must pay the plaintiffs' costs on the High Court scale.

Edwardes *v.* Daly.

This case came before Mr. Justice Kekewich, on an adjourned summons, on Wednesday last week. The question to be decided by his Lordship was whether Mr. George Edwardes, as the landlord of Daly's Theatre, or the executors of the late Mr. Augustine Daly, as the lessees of the theatre, were liable for the cost of carrying out certain alterations in connection with the electrical installation at Daly's Theatre, as required by the regulations of the London County Council. The Court had to determine whether under the lease of December 12th, 1901, between the plaintiff and the Hon. B. E. E. Barrington, Mr. Augustine Daly's English administrator, and an agreement of June 16th, 1903, plaintiff or defendants should carry out the work stated.

Mr. Jessell, K.C., for the plaintiffs, said there was a covenant in the lease by which the lessee undertook during the term indicated to comply with all the lawful requirements of the London County Council with regard to the structural alterations of the theatre. The Council had for some time been urging on parties the desirability of making the alterations in question, and, as an agreement could not be come to as to who should pay, Mr. Edwardes carried out the alterations by arrangement between the parties, without prejudice to the question in dispute, and it was arranged that a summons should be taken out in order that the point might be decided.

Mr. P. Ogden Lawrance, K.C., submitted that Mr. Edwardes could not recover from the defendants any money he had paid for the alterations.

Mr. Justice Kekewich, in giving judgment, held that Mr. Edwardes was the person accountable for the installation of the electric lighting. He thought the contract meant that he was to do whatever was profitable for the theatre; therefore, plaintiff must pay the expenses of the electric installation.

Greenwell & Co. *v.* John Lewis.

In the King's Bench Division of the High Court of Justice last week this case came before the Lord Chief Justice and a special jury. The plaintiffs are solicitors, and have for many years acted for the Borough of Marylebone. The defendant is a member of the Borough Council and of the London County Council. On or about October 29th, 1906, the defendant, plaintiffs said, falsely and maliciously wrote and published of the plaintiffs in a circular he caused to be sent to the members of the Borough Council and others, the following words:—

> Surely no sensible man who has read this Act (the Electric Lighting Act, 1888) can for a moment deny that if the borough solicitors, Messrs. Greenwell, had arranged for a few, say, half a dozen, of the ratepayers who had suffered this grievous expense to appear as witnesses, the House of Commons would by no possibility have refused the order for which the Borough applied. The responsibility rests on the borough solicitors, Messrs. Greenwell, and they have to some extent suffered for their negligence, since it has been resolved by the Borough Council that, although they have done the Borough's legal work for many years past, they shall never again be entrusted with the public interest. What was the fatal error, if nothing more, on the part of the lawyers? This. Instead of calling several reliable respectable witnesses properly representative of the Borough, men who had suffered from the gross defects of the company's (the Metropolitan Electric Supply Co., Ltd.) supply, who could clearly demonstrate to the House of Commons Committee how reasonable was the Borough's application for leave to compete with the company in accordance with the terms of the Act of Parliament (the Electric Lighting Act, 1882), they called one witness only to represent the whole of the great Borough in the matter where more than a million pounds of public money was at stake. That one witness was a man substantially interested in electric lighting companies, and it should not be forgotten that the issue of such a case as this affects one company directly, but indirectly all. Yet not only was this one man, who stood before the House of Commons Committee as the representative of all Marylebone, financially interested in other companies, but he had actually bought, not long before, £3,000 of shares in the very company against which he was posing as the Borough's champion. I myself indeed, in an interview with Mr. Greenwell, undertook to find six good and competent witnesses from all sections of the ratepayers concerned, private buyers of the light, professional men and tradesmen like myself.

The plaintiffs said that by these words the defendant meant that they were guilty of negligence and misconduct in their professional capacity, as solicitors to the borough, and had incompetently and improperly discharged their duties, and had made use of their position for corrupt and improper purposes. They also complained that the defendant wrote:—

> Messrs. Greenwell were, of course, greatly to blame for allowing themselves to be the tool of the Chairman of the Committee (the Electric Light Committee of the borough), and have, in consequence, been deprived of their business as the borough's legal advisers.

It was said that this meant that the plaintiffs had been dismissed in consequence of their incompetence or negligence, and that in consequence of the matters complained of the plaintiffs had been put to much annoyance, and had been disgraced in their reputation and injured in their profession. Under these circumstances the plaintiffs claimed damages.

The defence was that the defendant did not publish the words, that if he did, they were not defamatory, that, in so far as they implied negligence and incompetence on the part of the plaintiffs, they were true, and last, that the words were fair comment on matters of public interest.

Sir Edward Carson, K.C., Mr. C. F. Gill, K.C., and Mr. Clarke Hall appeared for the plaintiffs; Mr. Rufus Isaacs, K.C., Mr. W. B. Campbell, and Mr. M. Gwyer represented the defendants.

Sir Edward Carson, K.C., in opening the case, said that the defendant owned a well-known drapery establishment in Oxford Street, and this action for libel was brought against him because of charges made by him against the plaintiffs of a most serious and aggravating character. He hoped to satisfy the jury that the libel was merely the averment of the malicious mind of Mr. John Lewis, who had raked matters up over a period of nine years. Mr. Lewis was a man who pursued extreme measures with everybody with whom he happened to differ in opinion, and the matter complained of was issued to discredit Sir James Brooke-Hitching in his candidature for the mayoralty of Marylebone. He would undertake to prove that plaintiffs had not been guilty of negligence nor incompetence, and that the reason of their no longer being employed in 1904 as solicitors to the borough had nothing to do with the incidents to be inquired into. So far from there being any question of dismissal, the whole matter arose upon an arrangement made after the Borough Council had been created, for doing the work. The learned counsel gave the history of the Marylebone electric lighting question, and said that the negligence charged was that plaintiffs did not make a sufficient case before the Parliamentary Committee that there were defects in the supply of the Metropolitan Electric Supply Co.

Evidence was given in support of the plaintiffs' case, and the hearing was adjourned.

Mr. Edward E. Greenwell, senior partner in the plaintiff firm, denied the charges made against his firm, and said the steps they took were those advised by counsel.

In cross-examination by Mr. Rufus Isaacs, witness was taken through many details of the fight waged in Marylebone some years ago over the question of the electric light, and said that he had seen in the Press that Sir Thomas Brooke-Hitching gave an undertaking that if he were elected as mayor he would bring an action for libel against Mr. Lewis in respect of this matter.

And you know he has not done it?—I believe he has not.

The circular was mainly an attack on Sir Thomas Brooke-Hitching?—It looks like it.

Referring to a letter to the Mayor of Marylebone in 1904 after Mr. Lewis's assessment had been raised from £5,000 to £8,000, the plaintiffs being solicitors for the borough, Mr. Rufus Isaacs asked witness if he suggested that his name was mentioned by Mr. Lewis out of malice, and witness replied that he thought so.

How long have you known Mr. Lewis?—For 25 years.

He is a public man, and a member of the London County Council?—He was, but he lost his seat at the last election.

That is nothing against him?—No.

He was a very public-spirited man, was he not?—I would rather not express an opinion.

It comes to this, that your charge of malice is founded on the fact that you were acting as solicitors for the Assessment Committee when he was unsuccessful in some appeal?—I think so. I am sorry to say so.

Witness went on to say that Lewis stated in Court that he had a strong objection to showing his books to a director of a company carrying on a rival business next door, who was one of the gentlemen sent by the Council to survey his premises. He admitted that that objection was a natural one. He denied that Mr. Lewis had told him he could get six good witnesses to go before the Select Committee. He did not know that there was a view among the ratepayers that the case had not been well conducted, but Mr. Lewis had that idea, and might have given it to others. It was not true that his firm were dismissed in consequence of this matter.

Mr. Freeman, K.C., who practises at the Parliamentary Bar, said he was one of the counsel briefed for the Marylebone Vestry. He and his colleagues considered very carefully the question of raising by evidence a case against the Electric Light Co. of unsatisfactory supply. They agreed that the first question was whether a competitive supply should be introduced, and the second whether it ought to be introduced by the local authority. The question of municipal trading was very much discussed. He and his colleagues accepted full responsibility for the way the case was presented to the Select Committee. Their opinion was that no question of defects would have any influence. There was no want of attention or skill on the part of Messrs. Greenwell. Quite the reverse, in fact.

In cross-examination by Mr. Rufus Isaacs, Witness said that evidence of defective supply would have been more relevant if the question had been one of purchase.

Corroborative evidence was given by Mr. Stewart, a member of the plaintiff firm, and others, and the case for the plaintiffs was closed.

Mr. Rufus Isaacs then opened the defence. He said that Mr. Lewis was one of the oldest inhabitants of Marylebone, and had carried on his business there for 40 to 50 years. He was a respected member of the district, and was a gentleman who was not afraid to speak his mind freely and plainly. There were three issues. One was whether the statements made alleging negligence and incompetence against the plaintiffs were substantiated; another, whether the circular complained of was fair comment; and the third, on which the defendant laid great stress and was very anxious to dispossess the jury's mind as to, was the question of malice. Mr. Lewis wanted to impress on the jury that the circular had not been dictated by malice. The jury now would only be troubled with the issues of fair comment and malice. Now that they had had the advantage of hearing Mr. Freeman, K.C., Mr. Pritt and Mr. Stewart, Mr. Lewis fully assented to the course that he (Mr. Isaacs) intended to take on his behalf

namely, the withdrawal of the plea of justification in so far as it alleged against the plaintiffs negligence and incompetence. Proceeding, counsel said that, though the criticism might be exaggerated, the defendant was entitled to make it. It was a mistake to say that these matters had been raked up after nine years. The criticism had been made at the time of the occurrences. The reason why the circular had been sent out was because Sir Thomas Brooke-Hitching was concerned in the matter. In the result, Sir Thomas was turned into a witness for the company instead of for the Vestry, and his being interested in other electric lighting companies was what led to the criticism of Mr. Lewis, who was indignant that no evidence was given by the Vestry in support of the allegation that the character of the electric light was bad. Under the circumstances, Mr. Lewis naturally came to the conclusion that the solicitors were to blame for not calling this evidence. All along, the idea of imputing corrupt motives to the plaintiffs was disclaimed.

Mr. John Lewis, the defendant, then gave evidence in support of his counsel's opening statement. He said he was the largest individual ratepayer in Marylebone, and one of the largest consumers of electric light. He had taken great interest in public affairs, and had been a member of the vestry for 25 years, and a member of the London County Council for six years. He had never had an unfriendly thought towards Mr. Greenwell, and believed that feeling was mutual. With regard to the matter in question, he frequently had to make complaints of the inefficiency of the Metropolitan Co.'s supply and the failure of the light. When the light failed there was a danger of customers helping themselves, and the employment of candles led to a danger of fire. He saw Mr. Stewart, and suggested that he could get him half-a-dozen witnesses on this point in as many hours. It was well known that many had suffered from the inefficiency of the light. Mr. Stewart simply shrugged his shoulders and said, "Oh, we shall not get the order." He denied that Mr. Stewart sent him a proof of his evidence. He was surprised that no evidence was given before the Select Committee for the vestry on the question of the quality of the light except that of Sir Thomas Brooke-Hitching.

The Lord Chief Justice: I shall tell the jury that so far as Sir Thomas Brooke-Hitching is concerned the circular cannot be complained of in this action—the whole point is the introduction of the plaintiffs.

Witness went on to say that with regard to the conduct of the action there was a general opinion on the Council that plaintiffs were negligent. He did not say that with any ill-will to Messrs. Greenwell.

The Lord Chief Justice: I cannot take that.

Witness: I formed that opinion.

The hearing was then adjourned.

On Tuesday the hearing was resumed and concluded.

Mr. Lewis continued his evidence, and said he sent out the circular complained of because he wished to warn the public men of London against vested interests getting further control of the electric supply. In his opinion electricity was in its infancy. The contents of the circular expressed his honest conviction. It was absurd to suggest that he was actuated by malice against Messrs. Greenwell. He was quite sure Mr. Greenwell would be incapable of doing so mean a thing as to try to raise his rates.

Mr. B. S. Straus, M.P., who was a member of the Electric Light Committee in 1897, gave evidence that there were a number of complaints as to the character of the light.

This closed the evidence

The Lord Chief Justice, summing up, said the question was whether this was fair comment, and whether the introduction of the plaintiffs' name and the charges against them were justifiably imported into the criticisms on Sir Thomas Brooke-Hitching.

After an absence of a quarter of an hour, the jury returned a verdict for the plaintiffs, damages £3,000.

Judgment accordingly, with costs.

Firth & Son *v.* Cardiff Corporation.

The *South Wales Daily News* says that an action has been entered by Messrs. Firth & Son against the Cardiff Corporation in respect of the termination of the former's contract for wiring for electrical purposes the new asylum at Whitchurch. On the matter going to arbitration, the decision went in favour of Messrs. Firth, who now claim heavy damages for alleged breach of contract from the Corporation.

Dudley Corporation *v.* Dudley, Stourbridge and District Electric Traction Co., Ltd.

The Lord Chancellor, Lords Robertson, Atkinson, and Collins resumed, in the House of Lords on June 25th, the hearing of this appeal. The appeal was from an order of the Court of Appeal reversing the judgment of Justice Swinfen Eady in regard to the price payable by the appellants to the respondents for railway No. 5, from Queen's Cross to Hales Owen Road. The basis of valuation contended for by the appellants was a "structural basis." The basis contended for by the respondents was that known as "the going-concern basis." Justice Swinfen Eady adopted the former view, and the Court of Appeal the latter. The arbiter made an award on both bases. If the contention of the Corporation was right, he fixed the price at £16,548, while if the respondents' contention was conceded, he awarded £32,576, this latter sum including, in addition to the permanent way and overhead equipment, the value of ten single-deck cars.

According to the *Birmingham Daily Post* Mr. Cripps, K.C., and Mr. C. H. Sargent, K.C., argued the case for the respondents.

Mr. Vesey Knox, K.C., replied for the appellants.

Their Lordships reserved judgment.

A Manchester Car Accident.

A Manchester tradesman, Mr. John Lancaster, gentlemen's outfitter, 90, Cross Street, obtained a verdict, with £650 damages, against the Manchester Corporation at the Manchester Assizes, on July 2nd, for an accident which befell him on February 11th last. The plaintiff had left his place of business, at the close of the day, and boarded a Palatine Road double-decked car, in Cross Street, to go home. On reaching the upper deck, he was about to enter the door, when the car, in passing from the single line on to the loop, gave a violent jerk. He instinctively seized the handle of the sliding door, with the result that the door gave way, and then, losing his balance, he fell over the hand-rail head-first into the roadway. He received considerable injury, and was taken first to the Infirmary and afterwards to his home at Withington, where he remained under medical care for several weeks. His injuries did not amount to permanent disablement, but he had not yet been able fully to attend to business. His business had suffered in consequence of his absence, and he claimed damages on that account as well as for the pain and suffering. Negligence on the part of the car driver was alleged in starting the car at an improper speed before the passengers were all seated. The Corporation was also negligent, it was contended, in respect of the car, which was so constructed as not to afford adequate protection in such an emergency; and also in respect of the line, which, at the point where the accident happened, was said to have too great a curve.

For the Corporation it was argued that the plaintiff's injury was due to his own want of care. Negligence on the part of the driver was denied; and, as to the construction of the car, the defence was that it was the best type of car known, and such as had received the Board of Trade's approval. In the course of the plaintiff's case a comparison was made between this type of car and the Salford cars, to the advantage of the latter, on the score of safety. A person could not, it was stated, under the circumstances described, have fallen into the roadway from a Salford car. The defendants' answer to this was that, by the construction of the stairway in the Salford cars, the driver's view was obstructed to right and left, and for that reason the Board of Trade did not recommend them. As to the track, evidence was given that the curve in Cross Street did not differ from the curves (where there is a single line with loops) in other parts of the city.

The jury, in giving their verdict, added a recommendation "That there should be more careful driving over points."

Mr. Shee, K.C., and Mr. Byrne were counsel for the plaintiff Mr. Langdon, K.C., and Mr. Rhodes for the Corporation.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Design of Turbo-Alternators.

In your issue of June 7th, on page 928, under the above heading, I find the following remarks:—"As distinguished from many turbo-alternators of foreign origin, the standard Dick, Kerr alternator is of the salient-pole type. This construction, with its lower magnetic leakage in field and armature, is conducive to better inherent regulation; it enables machines to be designed with lower stator iron losses, and, in conjunction with the possibility of using a larger amount of copper in the rotating field, increases the efficiency considerably."

From the wording of these sentences, I take it that the writer meant to compare the salient-pole construction with the cylindrical barrel-wound rotor type with smooth surface. If this is the case, I should like to point out that the statement that the salient-pole type has a lower magnetic leakage than the cylindrical type of rotor does not coincide with the real facts. As a matter of fact, calculations show that the magnetic leakage of a field system, as given in your illustration, is of the order of about 10 per cent. or more, whilst the magnetic leakage of a cylindrical type rotor is only of the order of from 3 per cent. to 5 per cent. depending on the shape of the slots, so that, if anything, this point should be put forward in favour of the cylindrical type.

Now if the statement referring to the "lower" magnetic leakage of the salient-pole construction is not correct, it is obvious that the conclusion drawn from this statement does

not hold good, viz., that it is "conducive" to better inherent regulation. As a matter of fact, there is no reason to believe that the cylindrical type rotor should necessarily involve a bad inherent regulation, inasmuch as this point depends merely on the ratio of the short-circuit current to the normal current, and on the leakage of the armature. On the other hand, it may easily happen that a salient-pole type machine has actually a very poor regulation, if it is not properly designed, or if a machine is put forward which is rated too high.

Further, in your article it is stated that the salient-pole construction "enables machines to be designed with lower stator iron losses." I am sorry to say that I cannot agree with this statement either, because the stator iron losses depend more on the dimensions of the stator, and not so much on the design of the rotor, although I am quite aware that the two different designs vary from each other in that direction, that relatively the salient-pole construction will have more copper, but less iron, as compared with the cylindrical type of rotor. However, even if this is admitted, your further statement that the efficiency is increased "considerably" on account of "the large amount of copper in the rotating fields" cannot be agreed to in this form, because it is well known to all designers of turbo-alternators that in such machines the iron and friction losses are much bigger than the copper losses. From this it follows at once that a decrease of the excitation loss due to an increased amount of copper will not "considerably" increase the efficiency.

Further, it is stated in your article, "the ventilation of the machine is also a special feature, although forced draught is not employed." It is not quite clear what the writer means by this, but I think I am right in assuming that the makers claim to have a rotor which *acts as a ventilator*, so that there is no need to provide a special fan. However, I do not feel inclined to regard this argument as a very strong one, inasmuch as I think that a smooth rotor is likely to produce less windage, and a special fan is likely to give a much better and a more effective action than a "field magnet," which is called upon to serve as a "ventilator." Anyhow, one would expect that such a "ventilator" would produce rather a big noise.

As far as this is concerned, it is very interesting to note that the designers had to adopt "the use of solid end shields, which, no doubt, has a material influence in reducing the noise, and prevents dirt from being drawn into the machine." This seems to show that there was a virtue made out of a necessity, inasmuch as, if the enclosing has a "material influence in reducing the noise," this must have been considerable with the open type machine. Would this not prove that the salient-pole type rotor is likely to make a noisy machine? I think it is obvious that a rotor with a smooth outside surface is much better in this respect.

Moreover, if the designers of the machine illustrated in your article found it necessary to use solid end shields, they only prove that there is a distinct tendency to abandon the open type design altogether for turbo-machines.

This development is quite justified, not only from the point of noise, but also from the ventilation point of view. If one considers that the sizes of the units put down in large power stations are becoming larger and larger, it is evident that with such large units the question of taking away the heat produced by the losses becomes more and more important.

If one keeps in mind that a modern power station might have a capacity of 100,000 H.P. in only a few units, one can easily realise that there are several thousands of horse-power dissipated in the form of heat. Under the circumstances, I feel sure that the time is not far distant when not only will the cooling air be drawn into the machine through special ducts in the foundation from the outside, but also the hot air will be taken away and not allowed to go into the power house.

In conclusion, I should like to say that it is not the object of this letter to condemn the salient-pole construction. I only wish to prevent readers of your article from being misled to an unjustified prejudice against the cylindrical type of rotor.

M. Kloss.

Stafford, *June 28th*, 1907.

The Literary Engineer.

I would not intrude myself upon your notice again, but for the fact that Mr. Walker brings my name into his letter in your current issue, under a charge of pedantry, because I criticised Mr. Frank's "sliding rails." Mr. Walker seems to have overlooked the humorous element in Mr. Frank's article and my letter.

I agree with much that Mr. Walker says, and appreciate the liability of some writers to commit the error of self-obfuscation, and consequent literary nebulosity. I hope I make my meaning clear.

May I remark, without laying myself open to the charge of pedantry once again, that I conclude my name with one "T" only?

Harold Elliot.

Manchester, *June 28th*, 1907.

Among some so-called "practical" men there appears to be a widespread suspicion that purity of grammar and eloquence of expression in engineering literature are a cloak to conceal a deficient knowledge of the subject written about.

To such men a well-turned phrase, some brilliant illustration, or a cleverly enforced argument apparently savours of the plausible, and is, therefore, summarily rejected by these representatives of a race which prides itself on a speedy detection of frauds.

One of the greatest misfortunes of the average practical man is that he cannot take an interest in any science or art beyond his own trade.

Book-learning is despised, likewise anything which tends towards cultivating the mind, such as an intelligent interest in politics, literature, art, and so forth. One cannot blame him if his thoughts are fixed upon the glorious vision of a coil of 7/16-cable, or if his soul alone responds to the romance of a double-pole "chopper-type" switch.

It is merely his misfortune that his appreciation of the benefits of this world is so narrow and limited.

It would be well for him if he could realise that every branch of study tends but to enlarge the mind, promoting the acquisition of more knowledge and the purer expression of one's thoughts and ideas.

But the obstinacy of the devout worshipper of "practical" and "rule of thumb" methods and thoughts is proof against all evidence or argument. A suspicious attitude towards intellectual attainments will ever be his, and perhaps he is content to remain one of those unfortunate beings whom Browning calls :—

"Finished and finite clods, untroubled by a spark."

W. J. H.

Westminster, S.W., *June 29th*, 1907.

Wiring Cost of Small Houses.

Whatever we may think of Mr. Seabrook's business methods, there can be no diversity of opinion as to his literary abilities.

Taking the bombastic proclamation issued to engineering firms to participate in the spoils of Silvertown, and the two letters which have recently appeared, we cannot but envy the talent he displays in making black appear white, and fact merely fiction.

Before deciding that West Ham is an El Dorado, where wiring contractors can accumulate wealth, free from the tyrannical laws and regulations of promoted meter-readers, we should like to know what he is doing with the salesmen, motor-fixers, and canvassers recently advertised for? If these men are in existence, how can Mr. H. Seabrook pose as the friend of the local contractors when he is doing his best to oppose the electrical trade?

The enormous power load of West Ham is not a development obtained by the dissemination of foolish literature, but the natural outcome of a vast industrial area in which cheap electricity is obtainable. The legitimate aim of the undertaking should be the continued production of cheap current.

There can be no need for the Council to dabble in retail business. For them to do so is a censure to local contractors, and a direct impediment to the many makers of electrical

machinery who are anxious to push for business in West Ham.

If the members of the Committee would inquire for themselves into the failure of similar attempts in other areas, or if they could realise how easily items of material and labour, that are in any way troublesome, slip into "public lighting" instead of "sales," they would hesitate before starting a business of doubtful benefit, in opposition to their best supporters.

Suum Cuique.

I have carefully read Mr. Seabrook's letter in the current issue of the ELECTRICAL REVIEW, and will bring the same before the next meeting of the Association, which does not, unfortunately, take place before Tuesday, July 9th, when a reply will be given for your next issue.

Edw. W. Jackson,
Hon. Sec., West Ham Electrical Contractors' Association.

London, E., *June 28th*, 1907.

Making Calcium Carbide in Ireland.

"Querist" wishes to know what electrochemical work could be carried on at a water-power generating station of 100 H.P., so as to keep the plant going at full load.

This is not only an important question, but a big order, with any generating station, especially with a water-power one, as the cost of generation is the same (except attendance) whether the plant works one or 24 hours per day. "Men may come and men may go, but I go on for ever!" This is not the case with plant steam or gas-driven, as the expenses rise in proportion to output.

In 1897 I carried out experiments at a water-power factory with which I was connected, with a view to ascertaining some profitable means of bridging over the unprofitable central station gap.

One of the experiments was most successful as far as it went, but business pressure obliged me to abandon the work. Since then it has been perfected, and is now a commercial success; but, to the best of my knowledge, no central station is availing itself of this unique manufacture (chemically and electrically considered). This is somewhat remarkable, considering that this particular industry is very flourishing at the present time—product never commanded a better price, and output is in direct proportion to current used—this is not so with calcium carbide; but the greatest advantage is that the product is some 20 per cent. greater than the raw material used, whereas with calcium carbide it is some 40 per cent. less than the raw material. Good as this is, it cannot vie with an electrochemical product, the patent of which is about expiring in the British Isles.

Although I stated that 100 H.P. was too small to produce calcium carbide commercially, it is to be understood that I meant if a complete plant of this size—building, power generators and furnaces—were being created, but in the event that building, power and generators are already in evidence, as I gather is the case with "Querist," this completely alters the complexion, as practically only furnaces and transformers would be required. If caustic lime can be delivered on the premises under 15s. per ton, and anthracite under 30s. per ton, calcium carbide would pay well, using current, say, 10 hours out of the 24. In such an instance, I should not use a furnace in the strict sense—simply work on the resistance principle. I have no hesitation in saying that practically all calcium carbide will be produced on this principle in the near future, as it has many advantages to recommend it.

Should "Querist," or anyone, wish to go further into this matter, viz., filling up the unprofitable central station gap, perhaps the Editor will be kind enough to place him in communication with me.

W. Antrobus.

Manchester, *July 1st*, 1907.

A correspondent wants to know the name and address of the makers of the "Evertrusty" draught gauge.

SOCIAL AMENITIES OF THE M.E.A.

THE Sheffield Convention extending over four days instead of practically three as at previous meetings, enabled one of them to be entirely devoted to a pleasure trip in which many ladies took part. Indeed, at no gathering in the history of the Association has the fair sex been so much in evidence, but whether this is an advantage or a hindrance to the avowed objects of these annual functions we leave members to decide. For ourselves we side with the Angels. After the business of the first morning a large proportion of those attending the Convention accepted the invitation of Messrs. Vickers, Sons, & Maxim, Ltd., to spend the afternoon in their River Don Works, and witness the rolling of armour plate and other highly interesting operations, such as the manufacture of big guns, &c. The firm has a very extensive electrical department where direct-current and alternating-current dynamos and motors were in process of construction, from the designs, we believe, of Mr. Ferranti. Electrical power is extensively used throughout the works, all the machinery, we understand, being made in the Vickers-Maxim shops.

In the evening a reception was given by the Lord Mayor and Lady Mayoress at the Town Hall, followed by a dance and supper to about 300 guests, but as we are not votaries of the art of Terpsichore, and never indulge in late hour attentions to the needs of the inner man, we retired at a respectable time, and left the company to the Ambrosial delights of the feast and the light fantastic toe.

The next day was a holiday, and some 230 of both sexes left Sheffield at 9.15 a.m. for Worksop, where we were met by charabancs, wagonettes, carriages, &c., in which we "entrained" for an excursion through the "Dukeries." Shortly after our start, the weather, which looked very ominous during the early part of the morning, completely changed, and the remainder of the day was gloriously fine and sunny. "What are the Dukeries?" As the guide-book has it—"A cluster of ducal houses has brought into existence an appropriate word, when it is explained that Worksop Manor, once the seat of the Dukes of Norfolk; Welbeck Abbey, the palatial residence of the Dukes of Portland; Clumber, the famous home of the Dukes of Newcastle; and Thoresby, once occupied by the illustrious Dukes of Kingston, and now by their noble descendant the Earl Manvers, are all within a radius of 4 miles." And after our experience of the trip, we can well re-echo the eloquent words of Sisson, our guide, philosopher and friend (at the modest price of one penny) when, in the following *excerpta*, he says:—"What recollections of a happy day crowd into the memory of those who have enjoyed the glories of the woodland scenery. And what pleasures, yet unrealised, are there in store for the weary sojourner in murky cities (had the writer Sheffield in his mind?) anticipating a tour through the forest glades where Nature invites the toil-worn traveller to breathe her freshest, purest zephyrs, wafting on the air the scents of a thousand perfumed flowers, gay with harmonious hues." *Mirabile visu!*

We wasted much valuable time—and money, too—at Welbeck Abbey in rambling (at 1s. per head) through the pleasure grounds, gardens and riding school, the latter a fine building, but full of emptiness with the exception of several workmen, who evidently looked upon us as if we were *Ferœ Naturæ* in charge of a keeper.

A second halt was called at Edwinstone, a pretty Saxon village on the confines of Sherwood Forest, for the purpose of allowing any of the party bent on objects of historic interest to visit the "Major Oak," a tree of remarkable dimensions, and within the hollow trunk of which a dozen people can squeeze themselves; but we observed that 95 per cent. of the company showed a decided preference for a more modern example called the "Royal Oak," with more inside accommodation!

Arriving nearly an hour and a half late at the Hop Pole Hotel, Ollerton, with its delightful surroundings, we made short work of a very excellent and capitally-served luncheon, and after a short rest we started on the return journey to Worksop, by way of the Normanton Inn, Clumber and Carburton for tea at the

Town Hall, which nobody wanted and of which but few partook. Many of the company visited the District Council's electricity works, but a few of the more venturesome, always on the *qui vive* for anything out of the common, discovered "The Old Ship," said to be of greater antiquity than the Priory Gatehouse. Here a merry half-hour was spent in viewing the interior, where the Major and a Bradford delegate exhibited themselves in a capacity hitherto undreamt of, and we came away sadder, if not wiser, men. After the entertainment at "The Old Ship," which still lingers fondly in our memory, the informal smoking concert later at the Royal Victoria Hotel, Sheffield, held out no attractions, although we incidentally heard that the Major and a certain Scotch Bailie were in great form as *raconteurs*.

Thursday, to many, was a *dies iræ*, for morning, afternoon, and evening were spent at the Royal Victoria Hotel; the annual general meeting, reading and discussing papers, and the dinner, all taking place at headquarters. The last-named function, from a gastronomic point of view, was not to be greatly commended, neither were the several luncheons provided on other days of the week; and, as an object lesson in catering, the management might with advantage take a trip to the Metropolis and make a round of some of the restaurants in the neighbourhood of Soho, Leicester Square, or Oxford Street, where infinitely better fare can be obtained for one-third of the cost. We mention this simply in the interests of the Association members, who, coming from all parts of the kingdom, expect a fair return for their outlay; to ourselves, it is a matter of indifference.

But when speech time came, the Lord Mayor captured the hearts of every municipal man, and this is how he did it:—

"The success of the Sheffield Conference," he said, "was largely due to the personal efforts of their president. It was satisfactory to find so many electrical officials joining together for the good of the community. The official must always be the backbone of the work, and on him must largely depend the success of the undertaking. It was satisfactory to know that they had officials in Sheffield who were zealous and keen; and if they wanted good men they must be prepared to pay a good price. (Applause.) They found, particularly amongst Labour members of their Councils, a good deal of jealousy and criticism on the subject. But he thought that Labour members would have to change their views upon this question of salaries. They would have to realise that they scarcely pay too much for the completely satisfactory and efficient official."

If we may paraphrase a familiar English quotation, it is not too much to say that *amor nummi* makes the whole world kin!

Sir William Clegg, too, in proposing "The Incorporated Municipal Electrical Association," struck a note which sounded pleasant to the ears of electrical men.

"The Electric Light Committee," said Sir William, "had had a most difficult task in carrying on their undertaking. The Sheffield Gas Co. was excellently managed by men imbued with a good deal of public spirit. The company produced gas cheaper, he thought, with only one exception, than any other place in the kingdom, and no one could reasonably find fault with the way this private company had managed their undertaking and treated their consumers. But all this had made the work of the Electric Light Committee very difficult. He was of opinion they would have to seriously consider what would be the wisest course to adopt in the future. It might be it would be in the interests of the city that the Electric Light Committee should open up negotiations with the Gas Co. for the purpose of purchasing the undertaking. The matter would have to be considered, probably in the near future."

But the visions of a gasless Sheffield were rudely swept away by Mr. Dixon, who, in replying for the visitors, said he did not allow Sir William Clegg's proposal with regard to the gas undertaking to pass unnoticed. Speaking as a manufacturer, he assured Sir William that such a suggestion would be strenuously opposed. Healthy competition was the very life of business, even in the affairs of a municipality. The time for purchasing the gas undertaking had gone by. If the opportunity had been taken 20 or 25 years ago, the gas would to-day have been helping to reduce the rates. But to propose that their ten-years old undertaking should absorb the old and successful business of the gas company was outside the bounds of practicability.

A musical programme was provided, in which Miss Clara North, Mr. Robert Charlesworth, and Mr. Harry Heath took part.

Miss North is a vocalist of whom more will be heard, for her pure and flexible voice, and her well-nigh perfect intonation and unaffected style, mark her out for distinction amongst the ever increasing number of singers on our concert platforms.

Mr. Charlesworth, the possessor of a fine natural voice, also sang most excellently, and the humorous items of Mr. Harry Heath were cordially welcomed.

At the risk of being thought hypercritical, we must confess that the toast of "His Royal Highness" the King, seemed wanting in Majesty! The same slip of the tongue was, curiously enough, repeated later in the evening!

Taking one consideration with another, the Sheffield meeting of the M.E.A. was, from a social standpoint, an unqualified success, much of which was due to the untiring efforts of Mr. C. McArthur Butler, the popular secretary of the Association, who on this occasion surpassed himself; and Mr. Fedden, the President, may certainly congratulate himself that the Sheffield Convention has been not the least enjoyable of the 12 gatherings which sum up the history of this youthful but eminently useful and practical body.

PARLIAMENTARY.

London County Council Tramways Bill.

The Select Committee of the House of Lords (Lord Kintore presiding) on Thursday, June 27th, commenced the consideration of the Bill promoted by the London County Council. Mr. Erskine Pollock, K.C., and Mr. L. Maccassey appeared for the Council; and Sir Ralph Littler, K.C., and Mr. Fitzgerald represented Mr. Robt. Horner, petitioner against the Bill.

Mr. Pollock, K.C., explained that the Bill dealt with various tramways in various parts of London. Part II of the Bill contained proposals for the construction of new tramways and reconstruction of existing tramways; Part III related to street works; Part IV, the purchase of lands; and Part V dealt with the extension of time for powers already authorised. To none of these parts was there any opposition; the only opposition was to Part VI, and that arose through the proposal to alter the Tramways and Improvements Act of 1906, so as to make the provision relating to obtaining the consent of frontagers to the alteration or doubling of tramways inapplicable to lengths of line not exceeding 30 ft. each. Mr. Robert Horner, who was the owner of Spitalfields Market, was petitioning against the Bill, as, he said, the proposal of the Council to run tramways with a double track down Commercial Road would seriously interfere with his rights and would be to the prejudice of traders in the market. As a matter of fact, Mr. Horner, he contended, had no *locus standi* to appear before the Committee, as he was only a lessee of the market, and that the right persons to raise an objection would be either the Borough of Stepney or the Corporation of London—but neither of those bodies was opposing the Bill. Mr. Horner, in his petition, said that the Council was doing an illegal action, but if that was so Mr. Horner had the remedy in his own hands—he could go to the court of law and get an injunction restraining the L.C.C. from using those rights which the L.C.C. contended were legal. He maintained that Mr. Horner's petition was a misapprehension, as it was based on past legislation, and as a notice to treat had been served on Mr. Horner, he objected to his appearing before the Committee.

Sir Ralph Littler having replied on the technical point raised, The Committee decided to allow Mr. Horner to appear.

Mr. Fitzmaurice, chief engineer to the Council, was called and supported Mr. Pollock's opening statement.

At this stage, the Chairman intimated that the Committee thought it desirable that if possible some arrangement should be come to between the opposing parties, and the Committee adjourned to see if this expression of opinion could be carried into effect.

At the resumption of the Committee on Friday, Mr. Erskine Pollock, K.C., said that the Highways Committee of the Council could not, in the public interest, insert any clause which would repeal any of the powers they obtained in 1901. Mr. Horner, in his petition, maintained that they were endeavouring under that Bill to legalise something done in 1906. The Council did not wish to put themselves outside any claim for damages arising from their action, and they were quite prepared to insert an amendment in Clause 38, which would protect the interests of Mr. Horner, and to the effect that they should not prejudice any rights vested in the lessee of the market under the lease of 1883. The Council were unable to agree to the suggestion of restricting the hours of running the cars.

Mr. Fitzgerald suggested that a loop line on either side of the site would meet all the requirements of facilitating the traffic, and he put in a clause restricting the hours of the cars running.

The Committee, after consulting together, announced the preamble proved.

Second Reading.—In the House of Commons on Monday the Middlesbrough, Stockton-on-Tees, and Thornaby Tramways Bill was read a second time.

Rawtenstall Corporation.—This Bill came before the Earl of Onslow's Select Committee of the House of Lords on Tuesday last week. The Bill authorises the reconstruction and electrification of existing tramways and the construction of new lines within and beyond the borough. It also gives power to the Corporation, in the event of the Bacup Corporation failing to purchase, to acquire so much of the tramways of the Rossendale Valley Tramways Co. as is within the Borough of Bacup. The Bill provides for the expenditure of £8,900 on the reconstruction of the Accrington tramways, £32,300 on the Rossendale tramways, £17,600 on the Bacup tramways, £55,000 for the construction of new tramways, £60,530 for electrical equipment of the tramways, and £8,000 to be provided for renewals. Formal evidence having been given in support of the Bill, the measure was ordered to proceed.

Tramway Orders Confirmation Bill.—This Bill came before the Earl of Onslow's Select Committee of the House of Lords on Tuesday, and was ordered to proceed. The Bill confirms Board of Trade Orders in respect to Audenshaw, Leeds, Huddersfield, Taunton and West Ham.

King's Norton and Northfield Urban District Council.—This Bill came before the Earl of Onslow's Select Committee of the House of Lords on Tuesday last week, and was ordered to go forward. The Bill provides for the reconstruction and alteration of tramways, and powers as to the electrical undertaking, as to a supply in bulk, and power to supply fittings, but not to manufacture them.

Official Test of Electricity Meters.—In the Parliamentary papers, Capt. Faber asks the President of the Local Government Board what facilities are obtainable by the general public for procuring an official test of electricity meters by any official of the Board of Trade, on payment of any prescribed fee; and whether electric meters, issued by the makers, are tested by any official before issue to the public. Mr. Kearly says that the Board of Trade have no power to undertake the test of consumers' electricity meters. Consumers may require their meters to be tested, on payment of a prescribed fee, by an electrical inspector, who may be appointed, as regards undertakings in London, by the County Council; and, as regards undertakings outside London, by the Board of Trade, on formal application being made to them where the undertakers are a local authority, and by the local authority where the undertakers are a company.

BUSINESS NOTES.

Book Notices.—*I.E.E. Wiring Rules.* We have received from the Secretary of the Institution of Electrical Engineers, Mr. G. C. Lloyd, a proof of the cover of the reprint of the revised Wiring Rules, inside which are printed the names of the Insurance Offices and Supply Authorities which have adopted the rules as standard practice. While we regret that there is room for all the names on the space allotted, which ought to be sufficient only for the obstinate exceptions, we are heartily glad to see that 35 insurance companies have come in, ten London and 17 provincial supply companies, Edmundson's Electricity Corporation and the Urban Electric Supply Co. (which control 47 supply undertakings), and, not least, the Incorporated Municipal Electrical Association, which presumably accounts for the absence of names of municipal supply authorities from the list. We hope that on the next occasion of reprinting, as suggested above, there will only be a few exceptions to record, for it is really high time that uniformity was attained in a matter which is not appreciably affected in this country by local circumstances.

The Working of Steam Boilers. By E. G. Hiller, B.Sc., M Inst.C.E. Manchester: Taylor, Garnett, Evans & Co. 1907. Price 1s.—This is the fourth edition of the excellent instructions for the working, treatment and attendance of steam boilers issued by the chief engineer of the National Boiler and General Insurance Co., Ltd. All ordinary kinds of boilers are dealt with, as well as superheaters and economisers; starting with the raising of steam in a boiler from the cold, the author discusses the qualities of various kinds of fuel, methods of firing, forced draught, water feeding, the effects of overheating of flue tubes and of sediment in the water, cooling and blowing off, and the cleaning of boilers. Boiler fittings are dealt with at some length, and examples of various kinds of corrosion are given. There can be few questions arising in the ordinary working and care of boilers which are not answered in this book, and the numerous illustrations are well executed and clear. The publication of such handbooks, embodying the accumulated experience of many years, gained from a very great number of boilers under all sorts of conditions, is a most valuable feature of the company's work, and Mr. Hiller is to be congratulated upon the form and substance of his handbook.

Summer Holidays.—The purpose of this little handbook, issued by the Great Eastern Railway Co., at 30, Fleet Street, E.C., is sufficiently conveyed by its title. We cannot forbear calling attention to the extremely pretty illustrations, both fac-simile water-colours and pen-and-ink sketches, with which it is adorned, and the letterpress, by Percy Lindley, is light and entertaining. Prominence has been given to the less known districts of East Anglia, and to the country between the Cromer coast and the Broads.

Elektrische Beleuchtung. By Dr. Berthold Monarch (Vol. VIII, Repetitorien der Elektrotechnik). Hanover: Dr. M. Jänecke. Price 5 M. 60 Pf.—The completeness and accuracy with which the means and methods of electric lighting are treated in this volume make it a valuable text-book of the subject. Starting with the definitions of the various lighting units, the writer discusses these in detail, and then proceeds with the subject of photometry. This section includes a description of a convenient arc lamp photometer arrangement, due to the author, in which the distance between the photometer head and the arc remains constant whilst measuring the candle-power at all angles. This is accomplished by suspending the arc lamp from the end of a long swivelling arm which can be wound up into any desired position by means of a rope and hand winch. Section II deals with the construction and arrangement of arc lamps, and Section III with incandescent lamps, including the various metal filament ones. Sections IV and V describe the arrangement of arc and incandescent lighting circuits, and the erection and care of lamps generally, whilst Sections VI, VII, and VIII deal with the light distribution curves for various types of lamps, the light efficiency, and the question of illumination in rooms, roads, &c. A good series of light distribution curves showing the effect of the position of the carbons in arc lamps, of the globes, of the shape of the filament in incandescent lamps, &c., accompanies these chapters

"Protection of Buildings from Lightning." By Alfred Hands. Reprinted from the *Royal Engineers' Journal*, March, 1907. London: J. W. Gray & Son. 1907.

"Science Abstracts." Sections A and B. Vol. 10, Part 6. No. 114. London: E. & F. N. Spon, Ltd. 1907. Price 1s. 6d. each.

"Electric Tramcar Handbook." By W. A. Agnew. 4th edition. London: Alabaster, Gatehouse & Co. 1907. Price 2s. 6d. net.

"Fortschritte der Elektrotechnik." By Dr. K. Strecker. Berlin: Julius Springer. 1907.

"Handelshochschule Berlin."—Vorlesungen und Ubungen im Winter-Semester, 1907-8. Berlin: G. Reimer. 30 pp. This prospectus gives particulars of the teaching staff and curricula of the Commercial High School, Berlin.

Plant for Sale.—The Metropolitan Asylums Board is inviting offers for the purchase of certain gas producers and electric generating plant, crane, &c., at Tooting Bec Asylum. See our advertisement pages for particulars.

Business Exhibition. — The first annual Business Exhibition was opened yesterday at Olympia, and will continue open until July 13th.

"Antioyl" Soap.—The difficulty of removing the traces of oil—especially dirty oil, containing iron—and grease from the hands has long been a trouble to engineers who have a proper regard for their personal appearance, and who wish to have clean hands in every sense of the phrase. True, soft soap will do a great deal towards this end, but, as one of our friends once remarked—"At what a cost"! To meet this want, Messrs. F. S. Cleaver and Sons, of Red Lion Street, Holborn, have introduced a special "Antioyl" soap for the use of motorists, engineers, and others handling machinery, which, while free from the objectionable qualities of soft soap, removes grease and stains with equal efficiency. We have tried some samples, and found them very satisfactory for the purpose in question.

Catalogues and Lists.—The Birmingham Engineering Co., Ltd., Hooper Street, Birmingham.—List No. 81, giving, in some eight small pages an excellently illustrated description of their capstan lathes.

Messrs. Johnson & Phillips, Ltd., Charlton.—36-page catalogue entitled "Everything Electrical," in which are given many fine photo-process illustrations of their different classes of manufactures, including feeder and switch pillars, junction and fuse boxes, switchboards, switches, measuring instruments, motor-starters, direct-current inter-pole dynamos and motors, arc lamps, projectors, insulators, landline material for telegraphs, telephones and power transmission, cable-making machinery, and so on. A speciality is made of polyphase machinery, and some machines of this type are shown, complete and in parts. Copies of this publication may be obtained on application.

The Electrical Co., Ltd., 163, Shaftesbury Avenue, W.C.—Pamphlet relating to their electric cooking and heating apparatus, showing and giving prices of a variety of kettles and water cans, water jugs, saucepans, frying pans, hot cupboards, hot-plates, plate warmers, restaurant apparatus, iron and curling-iron heaters, &c.

Messrs. Ludw. Loewe & Co., Ltd., Farringdon Road, London, E.C.—Copy of second and enlarged edition of their pamphlet (48 pp.) on "Limit Gauges," in which they give a full explanation of their limit-gauge system and its importance in connection with the manufacture of interchangeable parts. Copies of this publication can be obtained on application to the firm.

Messrs. D. Santoni & Co. (1906), Ltd., Beauchamp Street, Brooke Street, Holborn, E.C.—New price list (H 2) of their electric lighting accessories (lamp and switchholders, adaptors, ceiling roses, cut-outs, fuseboards, switches, &c.).

Messrs. W. H. Bailey & Co., Ltd., Albion Works, Salford.—Circular of their hand and power air compressors, motor-tire pumps, and tire pumps and testers.

Messrs. Newtons, Ltd., Taunton.—New pocket list of their "Zone" patent dynamos and motors. Prices and particulars are given in compact form for easily ascertaining prices, outputs, speeds, and weights, also dimensional drawings and illustrations.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown.—Catalogue just issued (No. 33) of their telegraph and testing instruments. It is a well-arranged and clearly illustrated list, showing prices boldly and at a glance, of fast repeaters, Morse apparatus, single-needle instruments, apparatus for mirror

working on cables, vibrators, lightning protectors, reflecting and needle galvanometers, testing sets, resistance boxes, condensers, conductivity testing instruments and many other lines of interest to telegraph and testing engineers.

Usines du Pied-Selle, Fumay (Ardennes).—Price circular relating to electric heating and cooking apparatus.

Messrs. Bray, Markham & Reiss, Ltd., Walthamstow.—Sheets showing their B.M.R. starters, rotor starters, and "New" type ratchet starters.

Edison & Swan United Electric Light Co., Ltd., London, E.C.—New leaflets, No. A2,092, describing, illustrating and pricing their "Ediswan" circuit-breaker—500-volt single-pole maximum current type; also No. A2,093, dealing in a similar manner with their ironclad power fuseboards for circuits of from 200 to 600 volts.

British Insulated and Helsby Cables, Ltd., Prescot.—A number of publications for filing, relating to their Coraline soldering paste, portable hand-lamps, magnetic lampholders, the Merz-Redman electrically-controlled switch-frog, Oliver's patent mechanical ear and Prescot section insulators.

British Thomson-Houston Co., Ltd., Rugby.—Pamphlet No. 204, describing and showing in the company's usual excellent style their two and three-phase induction motors; also an index sheet to current B.T.-H. publications.

Trussed Concrete Steel Co., Ltd., Caxton House, Westminster, S.W.—Interesting publication, in which is given an account, with many pictorial views, of a large motor-car factory, which is built throughout on the Kahn system of reinforced concrete.

Dissolutions and Liquidations.—I.T.E. Electric Co., Ltd.—This company on June 7th resolved to wind up voluntarily, with Mr. P. F. Huddlestone, 72, Finsbury Pavement, E.C., as liquidator.

Light Cure and Electro-Therapeutic Institute, Ltd.—A meeting is to be held at Town Hall Chambers, Fargate, Sheffield, to hear an account of the winding up from the liquidator, Mr. W. F. Mohr.

Atmospheric Electrical Purification Co., Ltd.—A meeting of this company is to be held at 21, Spring Gardens, Manchester, on August 2nd, to hear an account of the winding up from the liquidator, Mr. E. E. Groome.

Harfield & Diggins, ironmongers and electricians, 13, Abingdon Road, Kensington, W.—Messrs. J. A. Harfield and G. Diggins have dissolved partnership. Mr. Harfield will attend to debts, and will continue the business in his own name.

D. Santoni & Co., Ltd.—A meeting is to be held at 15-17, Beauchamp Street, Holborn, E.C., on August 2nd to hear an account of the winding up from the liquidator, Mr. K. Fiedler.

A.B.P. Accumulator Co., Ltd.—A meeting is to be held at 39, Victoria Street, S.W., to hear an account of the winding up from the liquidator, Mr. T. A. Pallister.

F. & W. Bracher, gas and electrical engineers, &c., Redcliffe Street, Bristol.—Messrs. F. C. & W. S. Bracher have dissolved partnership. Mr. W. S. Bracher will continue the business and attend to debts.

Trade Announcements.—The Henry Wells Oil Co. have removed to new works which they have purchased—Imperial Oil Works, Salford, Manchester. We understand that these premises have 10 times the capacity of their old works, and are equipped with complete modern plant for the production of lubricants.

Messrs. Morris-Hawkins, Ltd., of 9½, Union Court, Old Broad Street, E.C., have purchased the business of the Morris-Hawkins Electrical Co., Ltd., inclusive of plant, machinery, patterns, goodwill, stock-in-trade, &c., and are now in a position to supply standard Morris-Hawkins motors and dynamos, and all spare parts. A large stock is held.

Messrs. Huggett & Worthington, electrical engineers, of Warrington, have opened new business premises at 85, Bridge Street.

Messrs. Wheatley Kirk, Price & Co., engineering valuers and auctioneers, of London and Manchester, inform us they have opened offices at 26, Collingwood Street, Newcastle-on-Tyne, and have appointed Mr. W. T. Stutchbury as resident district manager there.

Messrs. W. and R. Jacobs are carrying on business as wholesale suppliers of electrical materials at 39c, King William Street, London, E.C., where they will have the active help of the Messrs. Hale Bros., to whom they are successors.

Messrs. Bagshawe & Co., late of Tower Royal, E.C., notify that all communciations must be addressed to them at Dunstable Works, Dunstable. We have received a leaflet relating to their coal and ash elevator manufactures.

The Electric and Ordnance Accessories Co., Ltd., announce certain alterations in the management of their branch offices. Mr. V. Delebecque, until lately Birmingham branch manager, takes charge from July 1st of the company's Manchester branch, in succession to Mr. D. C. Bate, whose agreement with the company has terminated. Mr. J. Booker has been appointed to succeed Mr. Delebecque as manager to the Birmingham branch.

Messrs. R. J. Nicholson & Co., of Macdonald's Lane, Corporation Street, Manchester, now have branches at Newcastle-on-Tyne and Bath. From the former, which is situated at 77, High Bridge, the North of England will be worked under the supervision of Mr. T. R. Martin, while Mr. C. G. Smith and Mr. Talbot will look after the West of England from the Bath office at Northgate Works. At each of these branches one of the "Ideal" petrol-electric sets will be on view.

Burma.—Messrs. J. Stone & Co., Ltd., have supplied their electric train lighting apparatus to the Burma Railways Co.

Annual Outings.—The annual outing of the employés of the New System Private Telephone Co., Ltd., took place on Saturday, 29th ult. Upon arrival at Hastings the party went by brake through the beauty spots surrounding this popular resort. Luncheon was served at "Ye Old Jenny Lind," the chair being taken by Mr. R. L. Murray, the chief engineer. A telegram was despatched to Mr. Ernest H. Lamb, M.P., the managing director of the company, wishing him a speedy recovery from his indisposition.

Bankruptcy Proceedings.—R. S. Blackburn, electrical engineer and contractor, Osborne Street and Ribstone Works, Helden Bridge.—Petition filed June 4th, and adjudication order made June 28th.

LIGHTING and POWER NOTES.

Accrington.—A request by Clayton-le-Moors for a supply of electricity for lighting purposes, has led the Electricity Committee of the Corporation to communicate with various local authorities seeking their sanction to an application for a provisional order, enabling the Corporation to supply energy in neighbouring areas.

Amersham.—The Chesham E.L. and Power Co. has informed the U.D.C. that it intends applying to the U.D.C. for a prov. order for E.L. The Council has deferred consideration of the matter pending the arrival of further particulars.

Australia.—Melbourne.—The electric supply undertaking made a net profit of £17,601 for the year ended February 28th. The gross revenue amounted to £61,189, while working expenses absorbed £35,660. Other items of expenditure, such as interest on capital, commission and exchange (£14,385), sinking fund at 1 per cent. (£4,400), depreciation and renewals at 2 per cent. on £415,150 (£8,303), totalled £27,927, leaving the balance stated above, which, added to the credit balance from the last year, viz., £229, leaves available the sum of £17,830.

Birkenhead.—The gross profits of the electric lighting department for the past year amounted to £10,552, and, after payment of interest, sinking fund and income-tax charges of £7,400, there remained a surplus of £3,151, as compared with £2,210 in the previous year. The renewals fund now amounts to £9,241, equivalent to 7·10 per cent. of the total capital outlay. Capital expenditure for the period covered by the report amounted to £8,241, and there was an outstanding debt of £112,090.

Brighton.—The working of the Corporation electricity undertaking during the last financial year resulted in a deficit of over £10,000, and compares with a deficit of £976 in the previous year and a surplus of £5,381 in 1904-5. It will be recollected that heavy capital expenditure has been necessarily incurred in providing modern generating plant of large capacity, which is not as yet all productive. The old North Road works have now been closed for generating purposes, and it is estimated that there will be a saving of some £12,000 next year in the cost of production. The total capital expended now amounts to £758,279.

Bury.—A L.G.B. inquiry was held last week into the application by the T.C. to borrow £22,500 for the purposes of the electrical undertaking. It is intended to open offices and a showroom for electrical apparatus.

Cheltenham.—The T.C. has received from the L.G.B. sanction for a loan of £6,825 for additions to the plant at the electricity works.

Cuckfield (Sussex).—The R.D.C. has received notice that the Haywards Heath Electric Supply Co. intends applying to Parliament for power to supply energy in the districts of Haywards Heath and the Cuckfield U.D.C. and R.D.C.

Derby.—A L.G.B. inquiry was held on June 26th into the application of the T.C. for a loan of £51,850 for the extension of the electricity undertaking. There was no opposition, but the Inspector (Mr. H. R. Hooper) criticised the action of the T.C. in accepting contracts for part of the work before lodging with the L.G.B. full particulars. The extensions include the building of a station adjacent to the existing one, sufficiently large to accommodate 7,500 H.P., and capable of enlargement to 20,000 H.P. The first instalment includes two 750-KW. units, with the necessary steam-raising plant.

Dover.—The T.C. has decided to supply electricity to the Admiralty in connection with the new Harbour Works at 3d. per unit, on a minimum annual consumption of from 150,000 to 175,000 units.

Dublin.—At a special meeting of the Corporation last week, a letter was read from the Secretary of the Lighting Committee stating that his committee had decided to apply for a further provisional order to enable it to extend the electric mains for the purpose of giving a supply to the Viceregal and other buildings in the Phœnix Park, and asking the Council to sanction it. The

income from the Viceregal lighting would be about £750 per annum. Sanction was finally given on the guarantee that nothing would be done without first consulting the Council.

Exeter.—The E.L. Committee has recomended the T.C. to contract for a supply of 5,000 Osram lamps in the next 12 months.

Framwellgate Moor.—The residents of this place have accepted the terms of the E.L. Co. for the supply of electricity for private lighting. A similar arrangement has been made at Brandon, the terms of a three years' agreement being 4d. per week for the first lamp, and 2d. each for each additional lamp.

Glasgow.—We are informed that Mr. LACKIE, chief engineer to the Corporation Electricity Department, has been instructed to visit the works of Messrs. Siemen Bros., at Berlin, and those of Messrs. Brown, Boverie & Co., at Baden, to inspect the turbo-dynamos being built there for Port Dundas station.

Havant.—A private company has informed the R.D.C. that it intends applying to the B. of T. for a prov. order for E.L. at Hayling Island.

Hoddesdon.—The U.D.C. has agreed to dispose of the prov. order for E.L. to the North Metropolitan E.L. Co., which will repay £222, the cost to the Council.

Ilkley.—Mr. W. Antrobus, of Longsight, Manchester, has put forward a scheme for the electric lighting of Ilkley by water-power from the River Wharfe. The maximum power would be about 200 H.P. A small stream at the other end of the town, having a fall of nearly 400 ft., could also be used. The two plants would be run day and night at full load, the surplus energy being used for electrochemical processes.

Knottingley.—The Electrical Distribution of Yorkshire, Ltd., has informed the U.D.C. that it proposes to apply for a prov. order for electric lighting. The Council has decided to discuss the matter with a representative of the company.

Leeds.—It has been decided to extend the E.L. mains from Kirkstall to the Bramley and Rodley districts at a cost of £15,220.

Leyton.—The U.D.C. has decided to increase the plant at the electricity works by a third generating set at a cost of about £4,000.

Liverpool.—The Electricity Committee has recommended the City Council to apply to the L.G.B. for sanction to borrow a further sum of £200,000 for electrical purposes.

London.—SHOREDITCH.—The B.C. has decided to reduce the illuminating power of certain street arc lighting with a view to reducing the cost of street lighting; it has also been agreed in future to place the Coronet Street plant under the charge of the destructor engineer, and to supply the electricity department with such energy as is generated from destructor steam at a price based on the coal and oil cost per unit at Whiston Street, plus 20 per cent. for stand-by charges.

STEPNEY.—The Electric Lighting Committee is in negotiation with Mr. Arthur Wright, former consulting engineer to the Council, with regard to the re-engagement of that gentleman as an expert with particular reference to the Blyth's Wharf extension scheme. Mr. Wright is asking for a six years' engagement at £800 a year. The Committee is equally divided upon the question of accepting these terms.

BERMONDSEY.—The income of the electricity department for the past year was £24,662, and £6,950 was carried to net revenue after meeting working expenditure. After meeting financial charges, a balance of £590 remains; 1,906,489 units were sold during the 12 months.

KENSINGTON.—The B.C. has come to an arrangement with the three companies serving the area for a supply of energy for all-night street lighting, at 1d. per unit; also for a supply to public buildings at 2½d. per unit, with rebates where the energy is used during a number of hours per day.

L.C.C. ELECTRIC SUPPLY BILL.—The rejection of this Bill formed the subject of a long discussion at Tuesday's meeting of the L.C.C., when the Parliamentary Committee recommended the Council to adopt a resolution expressing the opinion that it was a matter for deep regret that the Bill had been rejected, thereby depriving the elected representatives of municipal London of the opportunity of securing the provision of a cheap supply of electricity subject to public control. As an amendment, Mr. Gordon moved that the Highways Committee should be instructed to convene a conference of the various local authorities concerned, with a view to ascertaining the steps to be taken to place again before Parliament a comprehensive scheme for the development of electricity for London and adjoining districts, and that the Committee should report the results of the conference to the Council as soon as possible. During the discussion some rejoicing was expressed by the advocates of the municipal ownership and working scheme on account of the fate meted out to the Bill, but the amendment, which they supported, only received 41 votes as compared with 78 recorded against it on a division. A second division resulted in the adoption of the recommendation of the Committee by 77 votes to 41, being a majority of 36 votes.

Lower Bebington.—The 1902 E.L. order has been revoked.

Middlesbrough.—The Cleveland and Durham Power Co. is negotiating with the T.C. for the erection of a sub-station on land belonging to the Gas Committee, and in the vicinity of certain large works.

Oldham.—At the last meeting of the Electricity Committee, the engineer reported upon the financial position of the borough electricity undertaking. The number of units sold during the past year (omitting traction) was 1,217,916, or 173,436 more than last year. For traction the consumption amounted to 2,453,038 units, or 363,903 more than in the year 1905-6. The total output for the 12 months ended March 31st last exceeded by 447,339 units the output during the preceding 12 months, or practically 11 per cent. The revenue for the year amounted to £35,896 9s. 2d., and the expenditure to £18,212 6s. 9d., leaving a gross profit of £17,684 2s. 9d. Payments require to be made on account of interest and sinking fund, £16,224 11s. 0d., and a net profit remains upon the year's working of £1,459 11s. 0d. A credit balance is carried forward to next year's account of £91 13s. 2d.

Portsmouth.—A L.G.B. inquiry into the application of the T.C. to borrow £17,688 for electricity extensions, was held on June 27th. The local Property Owners' Association opposed the application, chiefly on the ground that the T.C. was proposing to introduce a differential tariff for supply.

Salford.—The Electricity Committee proposes to expend £3,000 in the purchase of electricity meters, and in a report on the subject the Committee says that during the past three years considerable progress has been made in the development of the undertaking, the output for power having increased 285 per cent., and the output for lighting 67 per cent. It is anticipated that this rate of progress will be maintained, and that the £3,000 asked for will cover the cost of meters required during the next three years.

Warrington.—The annual report of the electricity department shows that the gross revenue amounted to £16,238, and working expenses to £8,528, leaving a balance of £7,709. Out of that sum has been paid £2,634 interest on loans, and £2,558 contribution to sinking fund, leaving a net profit on the year's working of £2,516.

TRAMWAY and RAILWAY NOTES.

Assessment of Light Railways.—The Wakefield Corporation has sent a circular letter to all the local authorities in England and Wales, asking them to join on the basis of a *pro rata* contribution according to the assessment of the tramways within their respective areas in carrying the case of the Wakefield Corporation *v.* the Wakefield and District Light Railways Co. to the House of Lords. The decision of the Divisional Court and the Court of Appeal has been adverse to the contention that tramways should be rated on the full and not on the one-fourth part of the capital value thereof, and the Wakefield Corporation desires to have this decision reviewed by the highest tribunal in the Kingdom.

Birkenhead.—The accounts of the tramway undertaking show a gross profit for 1906-7 of £21,697. Interest and sinking-fund charges absorbed a sum of £21,180, the available balance of £317 being transferred to the renewals fund. Last year the amount so transferred was £898. A sum of £1,066 has been charged to the renewals fund for repairs, leaving a balance in favour of that fund, after allowing for this year's transfer, of £11,024. A sum of £5,732 has been spent on capital account during the year, and the debt still to be paid off amounts to £306,891.

Brighton.—The Tramways Committee of the T.C. has recommended that the depôt shall be extended, and additional plant, including a power-driven hammer, provided, at a cost of £1,150.

Buenos Ayres.—It is announced from Buenos Ayres that the Mayor has placed before the municipal council a scheme respecting the establishment of a network of municipal underground railways of a total length of 63 miles, and the laying of two double-track lines is to be given out to contract by way of a beginning. The conditions of the contract are to be published in European newspapers. The payment for completed sections is to be made in municipal 5 per cent. bonds with 1 per cent. redemption.

East Sussex.—The B. of T. has confirmed the East Sussex Light Railway (Extension of Time and Amendment) Order, 1907.

Glasgow.—With further reference to the returns of the Corporation tramways for the past year, the total revenue amounted to £895,842, and working expenses to £485,256, leaving a balance of £410,586, which, with £3,510 brought forward, amounted to £414,096. From this there fell to be deducted interest, £63,769; sinking fund, £49,777; income-tax, £9,931; rental of Govan and Ibrox section, £5,079; to Paisley District Tramways Co., £4,874; depreciation fund, £85,032; permanent way renewals, £83,977; Parliamentary expenses, £6,977; and payment to the common good, £35,000—a total of £343,817, leaving a net balance of

£70,279. The latter was allocated to special depreciation on buildings, £25,000; on power plant, £20,000; and the balance to general reserve. Altogether 20,350,0367 car-miles were run, and 224,063,098 passengers carried. The average revenue per car-mile was 10·56d., and the average working expenses 5·721d. (or 5·353d., excluding power costs); the percentage of working expenses to receipts was 54·17.

Gillingham (Kent).—The T.C. has decided to ask the B. of T. for an order declaring that the working of the tramway from Richmond Road to the Swimming Baths shall cease, and that the powers of the Chatham and District Light Railway Co. shall be determined owing to the service having been discontinued for upwards of three months.

Halesowen.—The U.D.C. has sealed an agreement transferring its powers to construct a light railway between Halesowen, The Lye and Quinton, to a London firm.

Halifax.—The Tramways Committee has decided to abandon all powers for tramway extensions, with one unimportant exception.

Huddersfield.—The returns of the Corporation tramways undertaking for the year ending March last, show a total revenue amounting to £81,196, working expenses amounting to £40,041, and a gross profit of £41,155. After meeting financial charges there remained a net balance of £17,453, from which some £12,427 was allocated to reserve. During the year some 1,794,691 passenger car-miles were run and 15,252,150 passengers carried, the receipts amounting to 10·79d. per car-mile. The average working expenses amounted to 5·9d., and the percentage of working expenses to receipts to 49 32. The power expenses are somewhat interesting, as showing how cheaply a tramway undertaking may generate for itself. Some 3,722,598 units were utilised by the cars, averaging over 2 units per car-mile; production costs amounted to ·33d. per unit; including rates, &c., management, to ·36d. per unit; and including depreciation and financial charges, to ·62d. per unit.

Hull.—The returns of the Corporation tramways for the year ending March last show a total revenue amounting to £122,590, and working expenses to £71,582, leaving a gross balance of £51,008. After meeting financial and other charges, and placing £10,604 to reserve, a balance of £15,000 is carried forward. A sum of £10,000, brought forward from last year, was contributed to the District fund. Altogether 29,151,543 passengers were carried during the year, and 2.956,406 car-miles run. The traffic revenue per car-mile amounted to 9 84d., and the percentage of working expenses to income to 57·9. The undertaking possesses its own power plant which generated 3,561,854 units; 20,000 units also were purchased from the electricity department. The total works cost of the department's own plant amounted to ·63d. per unit., and including financial charges, to ·83d. per unit.

London.—Fulham.—The L.C.C. has drawn attention to the advisability of constructing tramways along the Fulham Palace Road between Putney and Hammersmith, with a view to completing the whole of the route between Putney and Harlesden in time for the opening of the Franco-British Exhibition at Shepherd's Bush. The L.C.C. favour the overhead system; it is understood that the B.C. will agree to the scheme on condition that certain road improvements are carried out.

Luton.—The T.C. has applied to the B. of T. for an extension of time until August 11th, 1908, for constructing the electric tramways.

Maidstone.—A B. of T. inquiry was held on June 27th with reference to the proposal of the T.C. to extend the tramways to Tovil. The only opposition was against a proposed line in King Edward Road.

Manchester.—The Tramway Committee has given instructions for the reconstruction of the tramway track in Market Street, Piccadilly, London Road, and Ardwick Green. This is the section of city tramways which was first opened, and upon which there is the heaviest traffic. Tenders are to be obtained for the supply of the special track work required

An agreement between the Manchester Corporation and the Sale District Council with reference to the lease of the Sale tramways, which the town clerk has been instructed to prepare, points to an early commencement of the work of laying the projected line between Sale and Northenden, with extensions to the Palatine Road terminus of the Manchester system, and the Gatley terminus of the Stockport system.

Manchuria.—A horse tramway, which eventually will be converted for electric traction, is to be constructed at Mukden, Manchuria.

Penge.—The Council has decided to oppose an application being made to the B. of T. to transfer the Mitcham and Sutton and the Penge and Annerley tramways from the B.E.T. Co. to the South Metropolitan Tramways Co., Ltd.

Stalybridge.—The returns of the Joint Board's tramway undertaking show a total revenue amounting to £31,939, but after meeting working expenses (5·389d. per c.m.) and financial charges, a deficit of £8,199 remains. It may be pointed out that the average revenue per c.m. only amounted to 6·54d., and the average journeys per head of population to 101, pointing to the poor use made of the tramways.

West Bromwich.—The arrangements made between the Corporation and tramway company, in regard to the leasing of the Corporation tramways, have recently excited much hostile criticism in the town, and resolutions expressing dissatisfaction have been passed by the local ratepayers, traders and other associations, with requests that a town's meeting should be summoned to consider the question.

TELEGRAPH and TELEPHONE NOTES.

American Telephone Convention.—In connection with the Convention mentioned in our last issue, a plan is on foot to combine 7,000 telephone companies of the United States and Canada into one huge organisation.

German Wireless Telegraph Stations.—According to statistics issued in Germany, there are now 641 complete stations of wireless telegraphy on the "Telefunken" system, whilst the total for the various systems throughout the world is put at 1,550. The stations of German origin are distributed over 31 countries in Europe, America, and Asia, and they are composed partly of land and coast stations and partly of ship stations, and portable plant for military purposes. At present there are 174 stations of the land and coast class, mainly with a radius of activity of 124 miles at most, although some of them extend to 310 miles, 430 miles, and over. Germany stands at the head with 36 stations, which are mostly on the coast of the North Sea and the Baltic, including the large experimental station at Nauen, which is claimed to cover a distance of 1,860 miles. The United States rank second with 20 stations, including Fire Island, Washington, New Orleans, and San Francisco; Russia has 17 stations, one of which is at Vladivostock, and has an oversea scope of 620 miles; Austria-Hungary has 10 stations; Denmark and Spain seven each; Holland six, and Norway and Sweden five each. Outside of Europe stations have been provided for the Argentine, Brazil, China, Cuba, Mexico, the Philippines and the Sandwich Islands. These stations are largely in State ownership and belong to the marine, post and telegraph services, &c. As to the stations on ships it is stated that 22 are equipped on German and Dutch vessels and 389 on warships. The German warships have 140 stations, those of Russia 126, those of the United States 43, Sweden 19, Austria-Hungary 17, Holland 10, Norway eight, Argentine six, Denmark, Spain and Brazil five each, Greece three, and Farther India two. Portable military stations have been delivered to the extent of 14 for Germany, eight for the United States, six for China, four for England, four for Austria-Hungary, and others for six other States.

New German Cable.—A scheme is reported to have been brought to a successful issue relating to the establishment of a new cable between Germany, Africa and South America, and Herr Guilleaume, of the Felten and Guilleaume-Lahmeyer Works, has been staying for some time past in Madrid for the purpose of promoting the proposal. It appears that the original idea was to lay the cable from Emden to Vigo, and thence to Teneriffe, but in deference to military views, the new cable will be laid directly between Emden and Teneriffe, the concession in regard to the latter place being for a period of 50 years. It is proposed to extend the cable from Tenerife to the German possessions in West Africa and thence to South America, the Argentine Republic in particular.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Cayenne-Pinheiro	Aug. 13, 1902	..
Curacao-Coro, Curacao-La Guayra, Curacao-Maracaibo (Closed)	Jan. 12, 1906	..
Reissa-Issa and Reissa-Yemani (Yemen)	Oct. 22, 1902	..
Tarifa-Tangier	Jan. 18, 1904	..
Port Arthur-Chifu (Closed)	Mar. 9, 1904	..
Garachico-Santa Cruz	July 12, 1906	..
Las Palmas-Arecife	Aug. 18, 1906	..
Landlines.		
Puerto-Barrios	Aug. 2, 1902	..

Postal Telegraphs.—Last week the House of Commons again considered the Telegraph (Money) Bill. The P.M.G. agreed to endeavour to have the telegraph and telephone accounts presented separately in future, and said that he did not think that any of the large services ought to be carried on at a loss if it could be avoided; but the House of Commons had made it impossible to work the telegraphs at a profit. The estimated loss through Press telegrams was a quarter of a million sterling, and the 6d. telegram also involved a great loss. The department intended to carry on the telephone service at a reasonable profit. The Bill was read a second time.

CONTRACTORS' COLUMN.

Openings for New Business.

BANSTEAD.—Additional day room accommodation at asylum (three blocks, at £1,337 each). W. E. Riley, superintending architect to the L.C.C., Spring Gardens, S.W.

BOLTON.—Extension to Cobden Mill for Messrs. Barlow & Jones.

Cotton spinning Mills in Deane Road (102,000 spindles). Bradshaw and Gass, architects, 10, Silverwell Street, Bolton; W. Townson and Sons, builders, Park Hill Saw Mills, Bolton.

BRECON.—Alterations and improvements to the Guildhall. Borough Surveyor, Castle Street, Brecon.

CAERPHILLY.—Rebuilding shop premises. J. H. Phillips, architect, Clive Chambers, Windsor Place, Cardiff.

CHORLEY.—Enlargement of Brunswick Mill.

Weaving shed for J. H. Gillett & Sons.

COCKFIELD (Co. Durham).—Club premises for the Cockfield Workmen's Club and Institute, Ltd. F. H. Livesay, architect, 107, Newgate Street, Bishop Auckland.

CRICKELWOOD.—Twenty houses. G. H. Paine, 62, Moorgate Street, E.C., architect.

DORKING.—Congregational school hall and additions to church. R. Lee, Great Bookham, architect.

DUNDEE.—Workshop for William Donald, Gardener's Lane.

Workshop for J. Scott & Sons, Ltd., manufacturers, Hillbank Road.

FARNWORTH.—Extensions at St. Gregory's R.C. schools.

FENAY BRIDGE.—Mission room in connection with Aldmondbury Parish Church.

FENTON (Staffs).—Important extensions to Rubian Art Pottery Works. R. T. Longden, architect, 68, Moorland Road, Burslem.

FOLKESTONE.—Soldiers' Home and lecture hall, Shorncliffe Camp (£3,000). A. W. Smith, architect, Maidstone: G. E. Wallis & Sons, builders, Hart Street Works, Maidstone.

GATESHEAD.—Important extensions to the Children's Hospital. Watson and Scott, architects, 48, Dean Street, Newcastle-on-Tyne.

GLOUCESTER (Yorks).—Girls' High School (£13,615). Wm. Crane, Ltd., builders, Gloucester.

GREAT AYTON (Yorks).—Elementary school (Edward Kitching Council School). W. H. Brierley, architect, 13, Lendal, York.

GREAT BROUGHTON.—House. W. G. Scott & Co., architects and surveyors, 2, Park Lane, Workington.

GUILDFORD.—Additions to Infirmary (£1,000).

HALIFAX (Ringby).—Stone-sawing shed at Swoles Moor. Jagger & Sons, owners.

Sprinkler tower at Holmfield Mills for J. Clay & Co., Ltd.

Additions to Washer Lane and Old Lane Dye Works. Bradford Dyers' Association.

Alterations and additions to shop in Union Street South for Wm. Jowett & Son.

(Briarley).—Woollen manufacturing mills. Sutcliffe & Sutcliffe, architects, Hebden Bridge.

HAMPTON (Middlesex).—Alterations and additions to grammar school (£5,000).

HARLESDEN.—Workhouse (£16,000). J. Hutton-Haylor, clerk to the Willesden Board of Guardians, 329, High Road, Kilburn, N.W.

HEXHAM.—New nave at the Abbey (£17,900). C. C. Hodges, resident architect, Holloway Bros., London, builders.

HOUNSLOW.—Congregational Church, renovation of interior (electric light to be installed). Griffin & Woolard, Ironmonger Lane, E.C., architects.

HULL.—New public schools (£4,597). Hull General Builders Co., Ltd., builders, Hull.

IPSWICH.—Extension of East Suffolk and Ipswich Hospital (£14,420). T. Parkington & Son, builders, 61 and 63, Crown Street, Ipswich; H. Percy Adams, architect, 28, Woburn Place, London, W.C.

KNARESBOROUGH.—New workhouse laundry. Bland & Bown, architects, North Park Road, Harrogate.

KENT.—Congregational Church at Shortlands (£2,500).

LEEDS.—Offices, &c., in Meadow Lane. C. S. Nelson, Sun Buildings, Park Row, Leeds.

LLANDAFF (near Cardiff).—Residence. G. E. Halliday, architects, 19, Castle Street, Cardiff.

LONDON (Wood Green).—Whitefield Congregational Hall at rear of Alexandra Palace (£4,094).

(Aldersgate Street, E.C.).—Extensions to *City Press* premises (£2,670). Merrin & Wagstaffe, 31, Fenchurch Street, E.C., architects.

(South Kensington).—Chapel, vestries and other additions to St. Peter's church. Herbert Passmore, 8A, Whitehall Place, S.W., architect.

(Walthamstow).—Shop in Higham Hill Road. W. Stewart, 4 and 5, Aldgate High Street, E., architect.

(Chelsea).—New Hall and Institute for Chelsea Temperance Society, 276, King's Road, Chelsea.

(Tottenham).—Three factories in Fountayne Road, for J. H. Clark and Co., piano frame makers, Broad Lane Ironworks, South Tottenham, N.

(Tottenham).—Two blocks of flats. W. Hall, 5, Blackstock Road, Finsbury Park.

(E.C.).—Nurses' home in connection with Bartholomew's Hospital (£87,500).

(Putney).—New General Hospital.

(Stepney).—Extension to the workhouse, St. Leonard's Street, E. T. G. Stacey, clerk, Barnes Street, Stepney.

(Princes Street, Oxford Street).—Business premises. Elliott, Son, & Boyton, 6, Vere Street, W., agents.

(Edgware Road, W.).—Enlargement of Metropolitan Music Hall. F. Matcham & Co., 9, Warwick Court, High Holborn, W.C., architects.

(Kingsway).—Premises for London Joint Stock Bank.

(Holborn).—Buildings for J. Buchanan & Co., distillers. Treadwell & Martin, 129A, Charing Cross Road, W.C., architects.

(Tottenham).—House, shop and office. G. H. Carter, 65, Torriano Avenue, N.W.

(W.C.).—Rebuilding 169, Strand. J. Chessum & Son, Monier Road, Bow, E., builders.

(York Street, Westminster).—Shops and offices. E. H. Adams, Chichester House, Chancery Lane, W.C., builder.

(Kensal Rise).—Seven houses. Trant, Brown & Humphreys, 332, High Road, Kilburn, architects.

(Kilburn).—Additions and alterations to school. G. E. T. Laurence, 22, Buckingham Street, Strand, architect.

(Tottenham).—Factory in Ashley Road for Eagle Pencil Co., 14, Fore Street, E.C.

LONDON (Lewisham).—Rebuilding "Joiner's Arms" public house. Carter and Ashworth, High Street, Lewisham.

(Lewisham).—Twelve houses. Scudamore & Son, Kellerton Road, S.E., builders.

(Lewisham).—Baptist chapel. A. E. Habershon, 4, Queen Street Place, E.C., architect.

(Streatham).—Five houses with shops. A. L. Guy, 4, Verulam Buildings, Gray's Inn, W.C., architect.

(Streatham).—Motor garage. Dowsett & Jenkins, 3, Sunny Hill Road, S.W., builders.

(Streatham).—Two houses. Treacher & Son, 73, Moorgate Street, E.C., architects.

(Montague Place).—Extensions to the British Museum (£400,000). J. J. Burnett, Glasgow, architect.

LUTON (Beds.).—Extension of power station (£1,857). G. W. Buckingham, builder, 21, Crawley Road, Luton.

MACCLESFIELD (Bollington).—Conservative Club. Whittaker & Bradburn, architects, 19, King Edward Street, Macclesfield.

MANCHESTER.—Cabinet works for Messrs. Smith, at Trafford Park. Hollinworth & Son, Patricroft, builders.

New works at Trafford Park, for Isaac Bentley & Co., Ltd., Vinoles Oil Works.

Works for the L. & N.W. Railway Co., at Trafford Park. Kirk and Randall, Woolwich, builders.

Extensive business premises corner of Mosley and Market Streets. Messrs. Lewis, universal providers, owners.

MERTHYR TYDFIL (Aberfan).—Business premises. C. M. Davies, architect, Merthyr Tydfil.

NORTH SHIELDS.—Elementary school in Preston Avenue for the Tynemouth Education Committee. Marshall & Tweedy, architects, Camden Chambers, Camden Street, North Shields.

NORWICH (Rackheath).—Public schools. Lacey & Upcher, architects, Upper King Street, Norwich.

NUNEATON.—Secondary schools (£9,000). F. P. Trepass, architect, Warwick.

OXFORD.—Chapel at Hertford College, Oxon.

PONTYPRIDD (Gelli).—Manager's residence for Cory Bros. & Co., Ltd. W. D. Morgan, architect, Post Office Chambers, Pentre, Rhondda Valley.

RAMSGATE.—Secondary schools to be built (£13,000).

RHONDDA (Tonypandy).—Fire station for the U.D.C. W. J. Jones, engineer, and surveyor, Council Offices, Pentre, Rhondda.

ROCHDALE.—Extension of electricity works. W. A. Peters & Sons, builders, Crossfield Mills, Rochdale.

RUGBY.—New theatre lit by electricity. F. Newman, architect, Rugby.

ST. ANDREWS (N.B.).—St. Leonard's School Senior Children's Convalescent Home.

SHEFFIELD.—St. Mark's Church to be lit throughout by electricity.

(Tinsley).—United Methodist Church and schools (£4,500). J. Amory Teather, architect, Sheffield.

SHEPSHED.—New factory in Sullington Road. Shepshed Lace Manufacturing Co., owners.

SLOUGH (Bucks).—Public school to accommodate 600 children. Lee & Farr, architects, High Street, Slough.

SMETHWICK.—Fire station. C. J. Fox Allin, borough surveyor, Smethwick.

SOUTHEND-ON-SEA.—Additions and alterations to Brewery Road School for the Education Committee. Greenhalgh & Brockbank, Bank Chambers, Weston Road, Southend.

Alterations and additions to London Road School, for the Education Committee. Cabuche & Hayward, Hamlet Court Road, Westcliff.

SOUTH SHIELDS.—School extensions (£4,790). G. R. Smith, architect, 67, King Street, South Shields; Robert Harper, builder, Back Charlotte Terrace, South Shields.

STAFFORD.—Extensive chemical works, for Chance & Hunt, Oldbury. Thos. Tildesley, builder, Willenhall, Wolverhampton.

STOCKPORT (Disley).—Conservative Club. R. B. Preston, architect, Diocesan Chambers, Manchester.

STOCKTON-ON-TEES.—Church Hall (St. George's). E. A. Whipham, architect, 59, High Street, Stockton.

STANHOPE (Co. Durham).—New (second) Sanatorium (about £6,000).

SUTTON.—Police Station (£8,000). J. Dixon Butler, New Scotland Yard, S.W., surveyor.

SYDENHAM PARK.—Extension of St. Bartholomew's Schools.—A. H. Ryan-Tenison, architect, 21, Great Peter Street, Westminster, S.W.

WESTHOUGHTON.—New cotton mill for Mr. Cooke, manufacturer, of Barrowford, Nelson, who is also about to convert a silk mill into a weaving shed.

Hotel for John Sumner & Co., Wigan. E. W. Dyson, architect, 10, Regent Street, Barnsley.

WIDNES.—Liberal Club (£2,500). E. L. Bower & T. F. Shepheard, architects, 10, Victoria Street, Liverpool.

WIGAN.—Extensions to Pagefield Ironworks, for Walker Bros., Ltd.

WILLESDEN.—Conversion of dwelling houses into shops. G. A. Sexton, 42, High Road, Kilburn, architect.

Factory for British Luxfer Prism Syndicate, Ltd., 16, Hill Street, Finsbury, E.C.

WELLINGBOROUGH.—New factory for J. C. Coldicott (£1,975). G. Henson & Son, builders, Midland Road, Wellingborough.

WOLSTANTON (Staffs).—Fire station and offices for the U.D.C. W. F. Slater, architect and surveyor, Overhouse Chambers, Burslem.

WOLVERTON (Bucks).—New Primitive Methodist church (£1,300). E. Green, builder, Northampton.

City of Wellington Electric Light and Power Co., Ltd.—The directors' report for the year 1906 shows a balance at the credit of profit and loss account of £12,886, including £2,306 brought forward, after paying interest on the debentures and dividends on the preference shares and expenses. An interim dividend at the rate of 8 per cent. per annum for the half-year ended June 30th, 1906, had been paid, and the directors now recommend a final dividend on the ordinary shares at the rate of 22 per cent. per annum for the half-year ended December (making 15 per cent. for the year) and writing off £5,000 from goodwill. A balance of £2,673 is carried forward. In view of threatened opposition by the Wellington Corporation, Mr. H. E. Salt, a director, visited Wellington at the request of the directors at the end of last year to come to an understanding with the Corporation. The result of the negotiations was that the latter agreed to purchase the company's undertaking and to take over the management as from July 31st, 1907.

CONTRACTS OPEN and CLOSED.

OPEN.

Beckenham.—July 22nd. Meters for the electricity department. See "Official Notices" to-day.

Belgium.—The municipal authorities of Flemalle-Grande, near Liége, have just invited tenders for the establishment of a central station in the town for the supply of electrical energy for lighting and power purposes.

Bristol.—Electric two-ton capstans (10) and movable electric jib cranes for the Docks. W. W. Squire, Engineer, Cumberland Basin, Bristol.

Cardiff.—July 16th. New telephones and alteration of telephone service at Cardiff and Ely workhouses for the Cardiff Union. A. J. Harris, Clerk, Union Offices, Queen's Chambers, Cardiff.

Devon.—July 12th. Electric lighting of Uffculme, Devon. Tenders to S. B. Sparkes, Coldharbour, Uffculme, Cullompton, Devon.

Handsworth.—July 10th. Traction and lighting feeders, fibre ducts and road-work. See "Official Notices" June 28th.

Hobart (Tasmania).—August 14th. Telegraph and telephone material for the Deputy Postmaster-General. Specifications, &c., at the office of the Australian Commonwealth, 72, Victoria Street, S.W.

July 29th. Telephone subscriber service meters, racks, and cable for the Deputy Postmaster-General at Hobart. General and special conditions, &c., can be seen at the General Post Offices at Hobart, Sydney, Melbourne, Brisbane, Adelaide and Perth.

L.C.C.—July 9th. Two 5,000-KW. three-phase steam turbo-generators with surface condensers, &c., for East Greenwich tramways generating station. See "Official Notices" June 14th.

L.C.C.—July 16th. 78 tramway feeder pillars and overhead equipment for Woolwich double track. See "Official Notices" June 28th.

L.C.C.—July 9th. Installation of electric light, bells, telephones and motors. See "Official Notices" June 21st.

Manchester.—Steam piping, superheaters, steam traps, &c., for Messrs. John Collier & Co. See "Official Notices" June 21st.

Perth (W.A.).—August 6th. Desiccating apparatus with motor-driven air-pump for telephone cable work for the Deputy Postmaster-General. Specifications at the Commonwealth Office, 72, Victoria Street, S.W.

Pontypridd.—July 8th. To supply and lay 3,000 yards of triple-concentric paper-insulated cables. See "Official Notices" June 21st.

Rotherham.—July 12th. Cable and meters for one year for the E.L. department. See "Official Notices" June 28th.

Russia.—The municipal authorities of Koutais, Caucasia, are at present inviting tenders for the concession for the establishment and working of a central station in the town for the electric lighting of the public streets, and for the operation of the tramways.

Spain.—August 12th. The Spanish Ministry of Public Works in Madrid is inviting tenders until August 12th for the concession for the construction and working of an electric tramway in the town of Valencia.

Spain.—July 16th. The municipal authorities of Cheste (province of Valencia) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Cheste (Valencia).

Spain.—The municipal authorities of Villacasten (province of Segovia) have just invited tenders for the concession for the electric lighting of the town during a period of four years.

Stepney.—July 22nd. Testing switchboard, motor-generator and transformer, also distribution board and earthing panel for the electricity department. See "Official Notices" to-day.

Sydney (N.S.W.).—August 14th. The Deputy Postmaster-General is inviting tenders for telegraph, telephone and electric light material.

Wednesbury.—July 23rd. Balancer boosters and accumulators for electricity works extensions. See "Official Notices" to-day.

Warrington.—July 16th. Erection of buildings for boiler plant extension for the electricity department. See "Official Notices" June 28th.

CLOSED.

Belfast.—The following tenders have been accepted by the Corporation:—

Siemens Bros. Dynamo Works, Ltd.—Lighting switchboard and motor-balancer.
Whipp & Bourne.—1,000-KW. traction panel.

Blackburn.—The Guardians on Saturday gave a contract to Mr. H. Garstang, electrician, to undertake all electrical repairs for the ensuing quarter in the local Union.

Cheltenham.—The T.C. has accepted the following tenders:—

British Thomson-Houston Co.—Meters and switchgear.
Heenan & Froude, Manchester.—Refuse destructor and steam raising plant, £4,266.

Dartford.—The U.D.C. has accepted the following tenders for annual supplies to the electricity works:—

Chamberlain & Hookham, Ltd.—Meters.
S. W. Gibson & Co.—Oils, block tin, fuse wire, &c.
E. E. Beaven.—Files, tools and screws, joint rings, packing, &c.
W. T. Henley's Telegraph Works Co.—House service cable, jointing materials, and accessories.

Derby.—The T.C. has accepted the tender of Messrs. Cowans, Ltd., for the enlargement and remodelling of the high-tension switchboard, at £133.

Exeter.—The T.C. has accepted the tender of the General Electric Co., Ltd., for the supply of 5,000 Osram lamps.

Glasgow.—The offer by the British Westinghouse Co. (£1,300) for one motor-generator, required in connection with a supply of electricity for power purposes by the Electricity Department of the T.C., has been accepted. The T.C. has also accepted an offer by Messrs. Bruce Peebles & Co., Ltd., to provide one motor-generator at £2,820.

London.—MARYLEBONE.—The B.C. has accepted, at £605, the tender of Messrs. Cowans, Ltd., for three switchboards for Manchester Square and one for Rathbone Place sub-station, delivery to be made in eight weeks.

L.C.C.—The Highways Committee of the L.C.C. has received the following tenders for the supply of high and low-tension switchgear for the various sub-stations indicated:—

	Switchgear for the Islington, Holloway Hackney, Clapton and Stockwell sub-stations.	Switchgear for the Lewisham, Forest Hill and Tooting sub-stations.
Johnson & Phillips	£12,692	£7,665
British Westinghouse Co.	14,197	8,349
General Electric Co.	14,802	8,548
Spagnoletti & Co.	—	8,924
Whipp & Bourne	15,198	9,037
Electric Construction Co.	16,255	9,306
Ferranti, Ltd.	16,565	9,513
Evered & Co.	20,058	10,236

The lowest tender—that of Messrs. Johnson & Phillips—is recommended for acceptance in each case.

We have received the following list of tenders submitted for wiring the new offices of the London, Edinburgh and Glasgow Assurance Co., Ltd., for electric light and power:—

	Tender No. 1.	Tender No. 2 (alternative).
Peto & Radford	£1,261	—
Benson & Co.	1,114	£1,080
Foot & Milne	841	834
H. J. Cash & Co.	814	811
Belshaw & Co.	774	754
Roger Dawson, Ltd.	707	697
H. M. Leaf.	681	664
Lea & Warren	690	657 (accepted)

Messrs. Morgan, Williams and Couzens are the consulting engineers, and Mr. Beresford Pite architect.

Luton.—For the electricity works the following tender has been accepted:—One double-stoker and self-cleaning compressed air furnace for a 30 ft. × 8 ft. diameter Lancashire boiler, Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton.

Manchester.—The Electricity Committee has accepted tenders as under:—

Bruce Peebles & Co.—Supply of one 250-KW. motor-converter for the Moss Side sub-station.
Ferranti, Ltd.—Switchgear for the Chorlton-cum-Hardy and Harpurhey sub-stations.
British Insulated & Helsby Cables, Ltd., and Siemens Bros. & Co.—Various lengths and sizes of cable.
Lancashire Dynamo & Motor Co.—One 160-KW. booster set for the Chorlton-cum-Hardy sub-station.
W. T. Glover & Co.—1,000 yards of 1 sq. in. cable.
Babcock & Wilcox, Ltd.—Supply of eight superheaters for Stuart Street station.
Mr. G. Wilkinson.—Two steam temperature feed-water heaters.

Portsmouth.—The Borough Education Committee has accepted the tender of Messrs. Southey, Ltd., of Portsmouth, for wiring for experimental purposes, and for electric ligat fittings, for the new Technical Institute, at £1,146.

The E.L. Committee received 13 tenders for new turbines and other plant for the electric light station. The lowest was £5,500. Before accepting any tender it was decided to refer the matter to Mr. E. Manville for his advice.

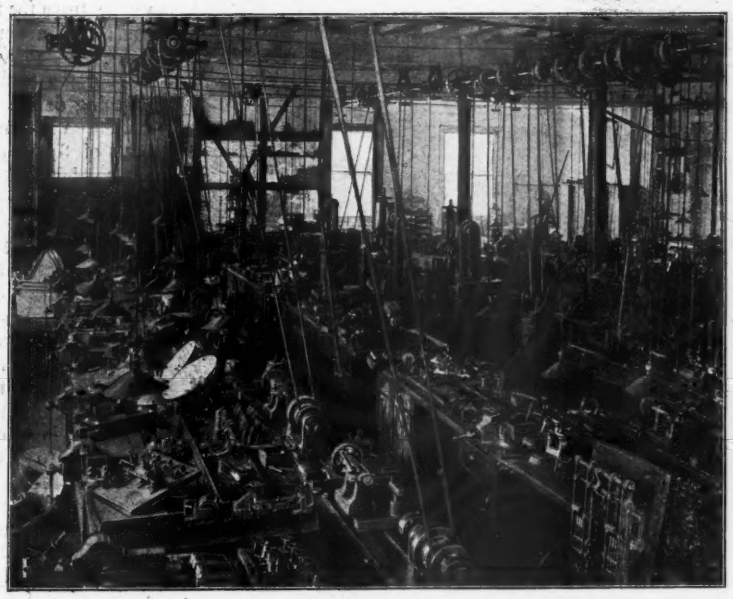
South Australia.—According to the *Australian Mining Standard* the Postmaster-General's Department recently accepted the following tenders:—

Unbehaun & Johnstone.—25 bells, 9s. each; 50 trembling bells, 2s. 7d. each; 2 miles lead-covered cable, £714 2s. 10d. per mile; 1 mile lead-covered cable, £414 2s. 10d.; 50 relays, 18s. 9d. each.
J. Bartram & Sons.—12 conductor cords, 2s. 2d. each; 24 mouthpieces, 9d. each; 30 transformers, 12s. each; 100 registers, 16s. each.
International Electric Co.—100 cords, 1s. 5d. each; 120 condensers, 3s. 6d. each; 60 condensers, 4s. each; four switchboards, £38.
Lawrence & Hanson.—24 metallic circuit switches, £12; 500 transmitters, 6s. 9d. each.
Oswald Haes.—5 miles cotton-covered wire, £2 17s. 6d. per mile.
Union Cable Co.—15 miles insulated wire, £9 18s. per mile.

Walthamstow.—The U.D.C. has accepted the tender of Messrs. W. T. Henley's Telegraph Works Co. for cable.

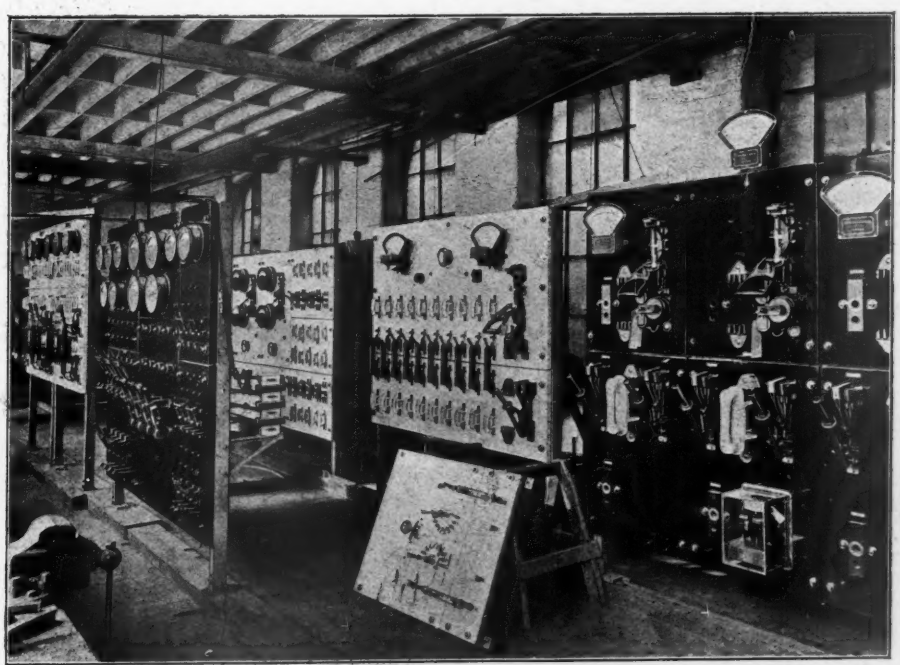
A SALFORD ELECTRICAL FACTORY.

A short time ago, in the course of a visitation of electrical works in the Manchester district, we found our way to the factory of Messrs. Dorman & Smith, who, as manufacturers of electrical switches and switchgear, fittings and accessories, are so well known. The firm were on the eve of celebrating their business majority, and that fact renders some details of their doings as they have developed along with the development of the electrical industry in this country, of some interest to our readers. The two gentlemen, Messrs. C. M. Dorman and R. A. Smith, who founded the firm by entering into partnership on Lady Day, 1886, were both originally locomotive engineers, who had taken up electrical work at the very commencement of the industry. The business was started, as it has been since continued, under the style of Dorman and Smith. In the beginning the offices were situated at 24, Brazennose Street, Manchester, with the firm's comparatively small works in Queen Street, adjoining. Most of the work carried out by them at that date consisted of complete installations of electric light on passenger steamers. In order to do the highest class of work they found it necessary to design and manufacture nearly all the fittings, switches and accessories for their own installations, and we understand that in this connection they were the first users of porcelain for the bases of both lampholders and switches, a practice which is now universal throughout the world. The demand for their improved electrical fittings became so geat that the firm decided to confine their attention entirely to manufacturing, and no actual installation work has been undertaken during the last 20 years. At the Electrical Exhibition of Liverpool, 1886, and at Newcastle-on-Tyne, in 1887, their exhibits were awarded medals, an honour which was repeated at the Crystal Palace in 1892.



Switchmaking Shop.

After the Brazennose Street premises had gradually been extended to their utmost capacity it became necessary in March, 1892, to remove the entire works and offices to their present position opposite Ordsal Lane railway station in Salford, and round this original Salford factory the present group of buildings has from time to time been erected on freehold land bought by the firm for the purpose; and even now further extensions are contemplated.



Switchboard Erecting Shop.

In January, 1893, Mr. H. G. Baggs joined the firm in the capacity of works manager, and ever since he has taken a

very active part in the development of the business, being responsible for many of the improved designs and methods of manufacture continually being adopted.

The London office has, since 1896, been at 94, Charing Cross Road, W.C., under the management of Mr. A. H. Dorman, and the Scottish office has been for some time managed by Messrs. Andrews & Co. at 198A, St. Vincent Street, Glasgow. The firm has an Australian branch, where a fairly complete stock is kept; this branch having for many years been controlled by Mr. Oswald Haes, now at United Chambers, 2, Hunter Street, Sydney, N.S.W.

Fittings Assembly Shop.

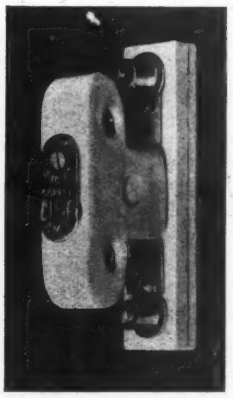
The works at Salford consist of the following shops, views of some of which are shown in our illustration: Two machine shops, two switchboard building shops, a grinding and polishing shop, a fittings assembling shop, as well as a pattern shop, a large glass and china stockroom, a metal and switch stockroom, and a brass foundry. The offices are arranged on modern lines, the accountants' office being situated on one floor with showrooms, &c., and the switchboard draughting office above. The works turn out switchboards of every class, and some idea of the scope of the work undertaken may be gathered from the illustrations. The view of one of the erecting shops shows a very large array of switchgear of all sorts, covering supply station boards, mill switchboards and smaller switchboards for various purposes.

The firm make a special feature of their "patent grip contact" circuit-breakers; in fact, circuit-breakers are their speciality.

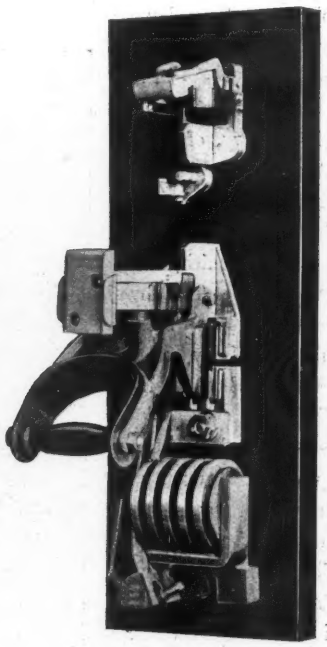
A large section of the works is devoted to the making of replacement fuses, of which the firm manufacture several types covered by their own patents, and they range in size from small wedge fuses for the control of a single light, to replacement fuses with a gripping device for dealing with currents of 3,000 amperes, 500 volts. Motor-starters of the liquid form are also a feature of the business, and liquid starting-gears are stocked for starting and reversing direct-current motors, and also for motor starting only, taking currents up to 1,000 amperes.

The foregoing are only special lines; we are informed that there is scarcely a main switch for any purpose that they have not in stock, or of which they have not patterns in their pattern store. They also turn out a large range of fittings of the strong varieties, such as are used in mills, factories, docks, on shipboard, &c., and also a large range of accessories in the way of fuses, switches, ceiling roses and lamp-holders.

Motor Starter—Liquid Resistance Type.



Patent Damper Fuse.



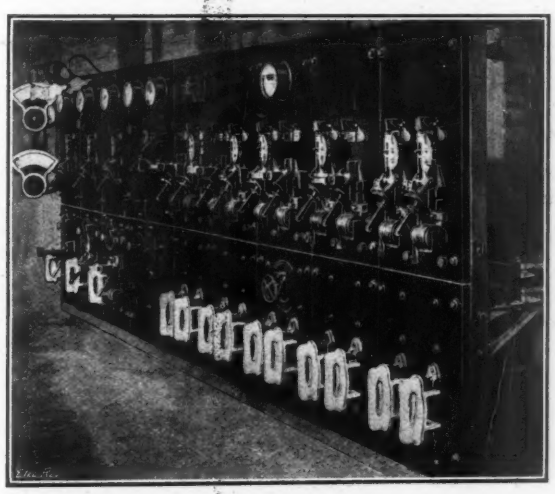
"Grip Contact" Circuit Breaker—Overload Pattern.

In our conversation with a member of the firm on the occasion of our visit to the works, reference was made to the main difficulties in the way of developing a manufacturing concern of the character of the Ordsal Electrical Works. The continual change of method in matters connected with electrical engineering render the selection of

stock patterns as serious and fickle a matter as in any business influenced by changing fashions.

The most serious aspect of business at the moment is brought about by the difficulties in the way of selecting stock patterns to cover the strikingly diverse requirements of consulting and municipal engineers. Where a switch of a certain construction and size is approved and recommended by one authority, the same production is utterly condemned by another authority on account of some minor particular not quite fitting a certain condition or rule, even though the conditions of use may be exactly the same in both cases. The diversities of municipal rules, and the requirements of consulting engineers, are stated to constitute a serious factor in restricting the development of a business dealing exclusively in apparatus for electrical distribution, and is, at the moment, the most potent reason for high costs and general depression and difficulties of business on account of the high establishment charges involved in keeping abreast of the times and filling every up-to-date requirement. Messrs. Dorman & Smith have, however, always confined their attention to the production of substantial and efficient switchgear, and on this account they have many advocates and friends wherever switchgear and fuses are used.

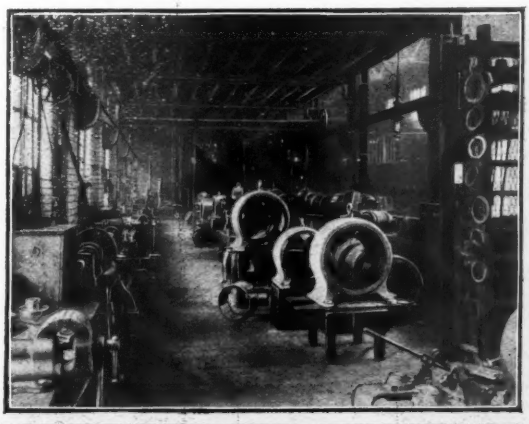
The Ordsal Electrical Works.

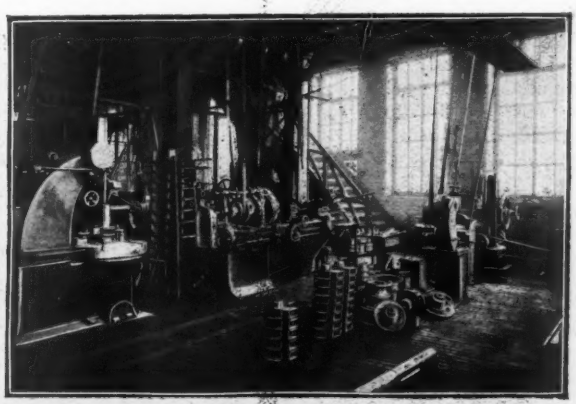


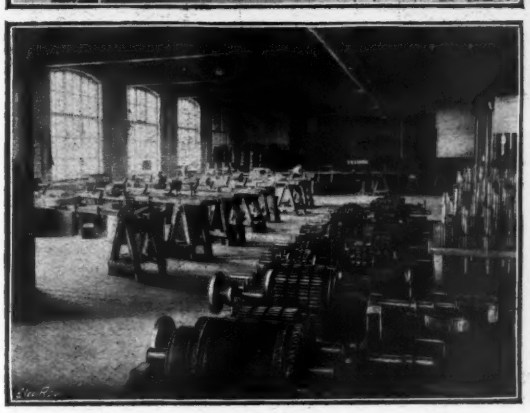
D. & S. Power and Lighting Switchboard.

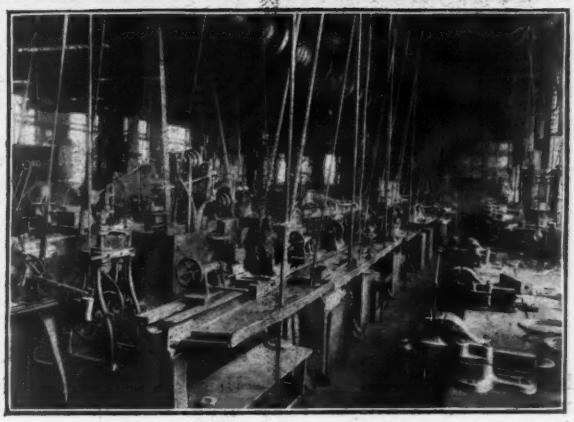
Messrs. J. H. HOLMES & CO.'S WORKS, NEWCASTLE-ON-TYNE.

We learn that Messrs. J. H. Holmes & Co., who have hitherto confined their attention to direct-current machines, have now taken up the manufacture of three-phase plant and alternating-current electrical machinery in general. To all









Corner of heavy machine shop.
Part of winding shop.
Light machine tools.
Assembly shop for medium-sized machines.

Figs. 1—4.—Views in Messrs. J. H. Holmes & Co.'s Dynamo and Motor Works.

connected with the electrical industry, the name of Holmes is familiar, although few realise how long the firm has been established. As far back as May, 1883, the original partners, Messrs. W. H. Holmes, Alfred Holmes, Theodore Holmes and John H. Holmes began business as electric lighting engineers, under the well-known style of J. H. Holmes and Co. In those early days the chief business carried on was in connection with small lighting installations, and the firm was among the first to install electric lighting for public illumination.

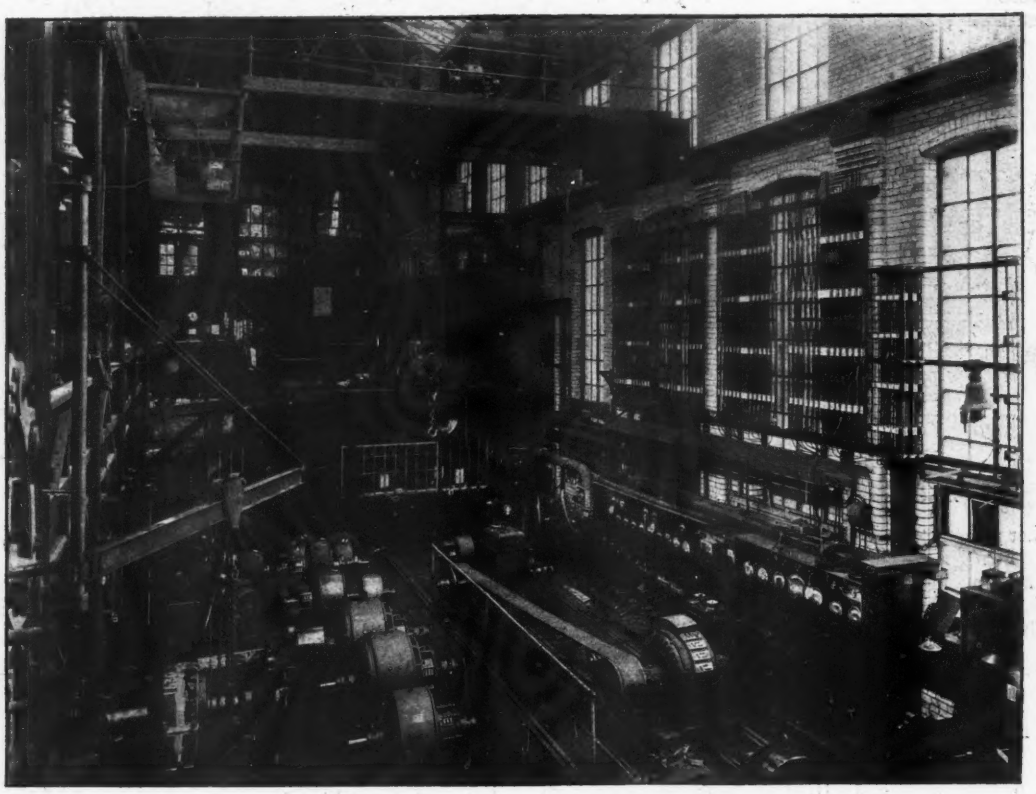


Fig. 5.—Heavy Machinery Testing Department.

The original workshops of Messrs. Holmes were opened in Stoddard Street in the year of the firm's inauguration, and it was not until 1887 that they removed to their present site, in Portland Road, Newcastle-on-Tyne. At first the firm's manufactures consisted mainly of arc lamps, lamp-holders, switches and accessories, and it is interesting to note that the quick-break type of switch, which is now almost universally used all over the world, was patented in the year 1884 by Mr. John H. Holmes. The first dynamo made by the firm was built in 1885; from it has developed the present flourishing business in the now well-known "Castle" machinery. That No. 1 "Castle" dynamo is still at work in Ireland, and seeing that it is now 22 years old, its historical value is considerable. The earlier machines built by the firm were of the Gramme-ring type; since then they have gone through the various stages of two-pole, smooth-drum pattern and slotted armatures, to their present up-to-date multipolar and interpolar machines.

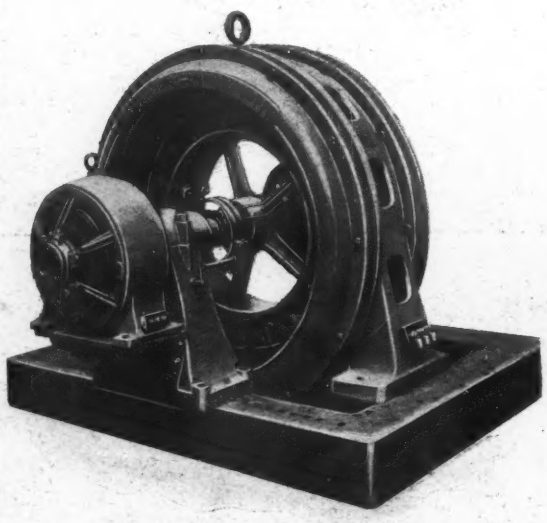


Fig. 6.—Holmes-Clayton 3-Phase Generator and Exciter.

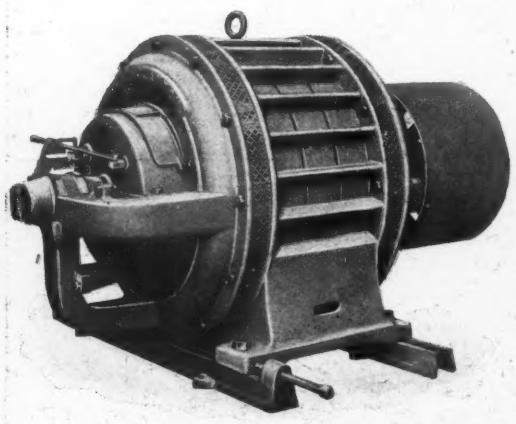


Fig. 7.—Holmes-Clayton 3-Phase Induction Motor, with Enclosed Slip Rings.

The first vessel built on Tyneside which was fitted with electric light, the ss. *Nonpareil*, was equipped by Messrs.

Holmes in the year 1884; from that date the electrical equipment of steamers has been one of their specialities, and they have carried out installations on no fewer than 878 ships, ranging from Royal Yachts down to ocean tramps. During the past twelve months they have booked orders for the electric lighting of 73 steamers, building not only in British shipyards, but also in yards on the Continent.

As early as 1889 Mr. John H. Holmes designed and patented a constant-pressure variable-speed generator for train lighting, and a considerable number of these were built and installed with success on the Midland Railway in this country, and on railways in Germany, France and Russia.

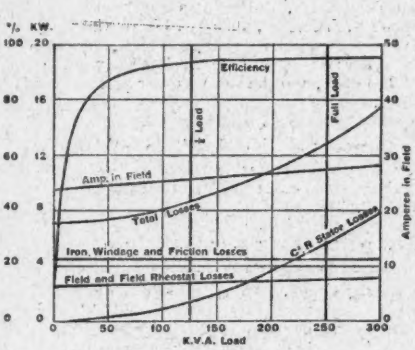


FIG. 8.—CURVES OF EFFICIENCY AND LOSSES ($\cos \phi = 1$).
Holmes-Clayton 3-phase generator; 250 KW. 334 R.P.M., 500 V.

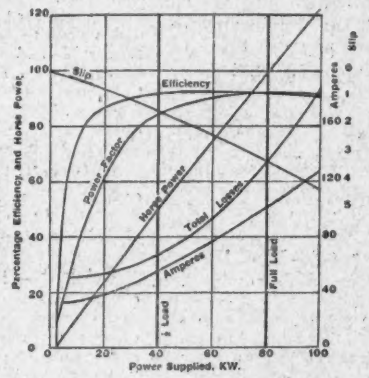


FIG. 9.—CHARACTERISTIC CURVES.
Holmes-Clayton 3-phase motor; 100 H.P., 600 R.P.M., 500 V. Max. load 242 H.P.; max. torque 2·65 × normal full-load torque.

The accompanying illustrations show parts of the firm's works, which, with the head offices, are situated in Portland Road, Newcastle-on-Tyne. The offices occupy first and second floors of the main building, covering an area of 3,900 sq. ft. They are situated in the same block as the chief section of the works, thereby facilitating the control of manufacturing and the settlement of questions requiring personal investigation. The system of costing and accounts employed by the firm is unique; the cost of every item under manufacture is daily made out, and it is claimed that at any moment the books of the concern can be closed and an accurate balance be obtained without the tedious process of stock-taking, which points to an admirable organisation.

The various departments of the factory include pattern shop, foundry, stores for castings, steel, iron and other raw material, machine shop, assembly room for small machinery, erecting shop, testing, packing and dispatch department. A separate department is reserved for the manufacture of electrical instruments and for switchboard work. These departments are situated in two main buildings, with separate buildings for foundry, pattern shop, instrument shop and stores, occupying altogether an area of 10,684 sq. yards. The machine shop is equipped with many of the most modern machine tools, including boring mills, chucking machines, large Gisholt lathes, automatic grinding machines, hydraulic presses, &c. The shop is served by electrical cranes, and most of the machines are fitted with individual motors, others being grouped together and motor-driven. Fig. 1, p. 21, shows a corner of the heavy machine shop, and fig. 2 part of the light lathe shop. Altogether some 130 motors, of sizes ranging from $\frac{1}{8}$ to 100 H.P., are utilised in driving the shops, their aggregate capacity being 780 H.P.

A special department is allotted to designing and making tools for the rapid production of repetition work, and for supplying accurate gauges, jigs, &c.

The sheet-iron department is equipped with heavy power presses and automatic notching machines for stamping stator and rotor iron cores, pole-pieces, &c., which after assembly are passed on to the winding and assembly departments. In the winding department many novelties are in use in the way of labour-saving devices; a special feature is the vacuum impregnating apparatus, whereby the wound armatures, field spools, &c., are first absolutely dried out under vacuum and afterwards impregnated with special varnish under pressure, the articles to be impregnated not being removed from the chamber between the periods of vacuum drying and impregnating, so that thoroughly damp-proof work is obtained. The windings, which are the most essential features of a machine, are all most carefully carried out. Fig. 3 shows part of the winding department for the lighter class of work, with armatures awaiting winding in the foreground.

A special feature of the works is that they manufacture details in large quantities, thereby ensuring cheapness and accuracy of work; the various parts of machines remain until required in well-organised factory stores, whence the assembly and erecting departments obtain them—frames of machines, bearing brackets, armatures ready wound, field spools, &c. Fig. 4 shows the assembly shop for medium sizes. The assembled machine is passed into the testing room, where there is a very complete equipment of testing apparatus. The testing department is served by a three-motor overhead travelling crane, and has test beds for machines of all sizes, with switchboards giving all the various voltages and currents required. Fig. 5, p. 22, shows one of the testing departments; a continuation of the same building is used for erecting heavy machinery, the whole being served by electric travelling cranes. Current is derived for testing and for driving the shops from a generating station adjacent to the testing department; the generating plant comprises four high-speed engines, directly coupled to generators of 330 H.P., steam being supplied by two Lancashire boilers at a pressure of 180 lb. per sq. in. After being tested, the machines are handed over to the painting, packing and shipping department, whence they proceed to their respective destinations.

In the department devoted to the construction of switchboards, instruments, building of commutators, &c., the machinery consists chiefly of lighter type lathes, milling machines, hydraulic presses, punching presses, drills, &c., which are driven through line shafting; one large floor is devoted solely to the manufacture of ships' fittings, brush-holders, projectors, and controllers, with a special room for calibrating the ammeters, voltmeters, wattmeters and other instruments which are manufactured by the firm.

One of the points which Messrs. Holmes emphasise is the necessity of making everything as far as possible "fool-proof," and in their switchgear ingenious interlocking devices are largely used. These devices are well constructed, strong and simple.

In an adjacent new building of five stories the manufacture on a large scale of the "Holmes-Clatworthy" printing-press motors and small motors generally is carried on. It is also in this building, which is admirably adapted for the purpose, that alternating-current induction motors are wound, assembled and tested. With their usual prudence and foresight Messrs. Holmes, when taking up the alternating-current business, have not started experimenting and losing time and money, but have taken over a complete, fully tested and approved system. They have entered into an agreement whereby they take up the manufacture for Great Britain and the Colonies of Mr. Aubrey V. Clayton's three-phase and alternating-current machinery and transformers. These newest and most modern induction motors, generators and other apparatus were originally developed at the Clayton-Unger works at Arbra, Sweden, and on them is founded the business of the large corporation, The Amalgamated Electrical Co. of Sweden, whose formation was described in our issue of December 21st, 1906. Mr. Clayton also acts for Messrs. Holmes as consulting engineer and designer. From this it will be seen that in this new line, as in other branches, Messrs. Holmes give their clients the advantages of the best modern practice based on the results of many years' experience.

A generator of 875 H.P. has already been supplied for a Midland colliery, together with four 100-H.P. motors

and one 55-H.P. motor, besides a number of motors on order. Fig. 6 shows the generator, and fig. 8 gives curves of efficiency, &c., for the same. It will be seen that the efficiency at full load, with power factor unity, including all excitation losses, is 95 per cent., a very high figure. Fig. 7 shows one of the 100-H.P. motors supplied; the efficiency and power-factor curves of this motor are given in fig. 9. The efficiency, at full load 92 per cent. and at half load 91·5 per cent., speaks for itself, and the power factor of 0·915 at full load is excellent. Mr. Clayton's induction motors and machinery generally have won high praise for their excellent characteristics. For a textile mill in Lancashire Messrs. Holmes have supplied a 300-H.P. three-phase generator and some 200 H.P. of motors, and they have at present on order for a firm in Wales a 500-H.P. three-phase generator, besides numerous motors of varying sizes from 3 up to 150 H.P.

NOTES.

Central-Battery Telegraphs.—Errata.—The latter portion of the final paragraph in the article on the above subject, published in our issue of June 28th, should read as follows:—"... consists in the winding of the coils differentially to a resistance of 500 ohms, so that the sounder can be placed in the direct circuit on long lines, thus obviating the necessity for a relay and local battery."

The Carshalton Tramway Accident.—Major Pringle, of the Board of Trade, has issued his report on the above accident; his conclusions are as follows:—

1. That the car entered the curve at a higher speed than that authorised by the regulations, or justified by the superelevation, and therefore ran the risk of derailment.

2. That the overturning of the car was caused by the wheels being locked by the severe application of the brake blocks.

He holds that driver Woodley was mainly responsible for the speed of the car, which should not have exceeded eight miles an hour down Park Lane, and that conductor Linney was responsible for the locking of the wheels, although his intentions were good. Both men had first-class characters, but had small experience.

In the course of his remarks, Major Pringle says that previous accidents have proved that a heavily laden car which commences to skid with a momentum due to a velocity of 12 to 15 miles an hour, will not, even on such a comparatively easy gradient as 1 in 36, readily lose its velocity, especially on greasy rails.

A Galloping Consumption.—A correspondent sends us the following extract from the *Western Mail*:—"A man rang up the gas company and asked: 'When do the entries for the spring handicaps close?' They told him he must have the wrong number —'We are the gas company.' 'Oh! that's all right,' he exclaimed; 'I want to enter my gas meter.'"

The Apprenticeship Question.—On Friday last a meeting was held at the Mansion House for the purpose of promoting the interests of the National Institution of Apprenticeship. The Lord Mayor presided, and the hon. secretary, Mr. J. Ballin, explained that the institution was founded to apprentice children to trades which required skill, to lend money for premiums, and to supervise the apprenticeships. Since May, 1905, 156 boys and 36 girls had been apprenticed; during May last 19 indentures had been signed, and 110 boys and girls were sent out on probation, while 200 boys were still awaiting places. In addition, 211 apprentices had been indentured by the institution. There were on the books the names of over 400 selected employers who had agreed to take apprenticeships, and the number of applicants for apprenticeship was over 40 per week. Lord Avebury emphasised the importance of training children in trades requiring skill, and it was resolved that apprenticeship was the best method for the purpose. Funds are urgently needed to carry on the work of this admirable institution; donations should be sent to Messrs. Robarts, Lubbock and Co., 15, Lombard Street, E.C., while Mr. J. S. Ballin, 5, Clarence Terrace, Regent's Park, will answer inquiries.

A conference was recently held in Cardiff to promote a scheme for the improvement of the education of engineering apprentices, and it was decided to issue a circular inviting the opinions of employers on the subject.

Educational Note.—We have received a prospectus of correspondence courses on mathematics and mechanics applied to engineering, from the "University Engineering College," Frankfort House, Stanstead Road, Forest Hill, S.E. These courses are graduated to suit the attainments of elementary and advanced students, and are designed to give them a thorough working knowledge of the subjects named. In the higher stages the use of vectors and the calculus, graphically treated, is taught. For those who cannot attend lectures and demonstrations in person, correspondence tuition is almost the only resource, and undoubtedly it is a powerful aid to private study.

Appointments Vacant.—The managers of the Brentry Certified Inebriate Reformatory, Bristol, want an engineer (£100). Visiting teachers are wanted by the L.C.C. for electrical wiring, electrical engineering, and electrical instrument making; working assistant for Malvern electricity department (£84). Full particulars of which appointments are given among our "Official Notices."

L.C.C. Commercial Audit.—It is announced that the special investigation of the L.C.C. tramways, steamboats and working-class dwellings accounts, will be made by Mr. W. B. Peat, president of the Institute of Chartered Accountants, who has selected as his colleague Mr. F. W. Pixley, an ex-president of the same Institute.

Annual Outing.—On Saturday, June 29th, the staffs of the St. Pancras Borough Council generating stations visited Portsmouth for their annual outing. After a look round the town, and a visit to the Town Hall, dinner was served at Madden's Handy Man Restaurant, Landport, with Mr. H. E. Cooper in the chair. The afternoon was spent in visiting the old *Victory*, the first-class battleship *Revenge*, both lying in Portsmouth Harbour, Southsea, Gosport, Fareham, and the various other places of interest in the neighbourhood.

Polytechnic Sports.—The Institute athletic sports and garden party in connection with the Borough Polytechnic Institute are to take place to-morrow at Institute Field, Red Post Hill, North Dulwich, S.E.

Cricket.—The Bexhill-on-Sea Town Hall staff and the officials and men engaged at the Electricity Works went to Sidley for their annual cricket match. Among those taking part in the game was the borough electrical engineer (Mr. W. T. Le Feuvre) and the borough surveyor. For the second year in succession the "Electricity Works" won, and, as winners, they received a fine set of stumps presented by Councillor Paton, chairman of the E.L. Committee.

Electric Shock Fatalities.—The *Daily Telegraph* says that early on Tuesday morning William Albert Rose, 44, of Manor Terrace, Harlesden, was engaged cleaning insulators at the Great Western Railway sub-station at Acton, when he came in contact with a 6,000-volt live wire. Both arms were burned to the bone, and one was only prevented from dropping off by the clothing. The body was terribly injured, and the man's boots were burned. Death was almost instantaneous.

On the North-Eastern Electric Railway on Sunday, the dead body of a man named Wm. Scott (26), of East Hollewell, was found lying near the live rail between Monkseaton and Backworth, the remains being burned. It is believed that deceased was walking home along the line and that he accidentally came in contact with the live rail.

Secret Commissions and Bribery Prevention.—At a meeting of the Council of the Secret Commissions and Bribery Prevention League, held on Tuesday at the London Chamber of Commerce, Sir Edward Fry was elected as first president, and the Archbishop of Canterbury, Earl Fortescue, Lord Avebury, Sir W. H. Holland, Sir W. Mather, and Mr. David Howard were elected vice-presidents. Mr. David Howard, who presided, was able to report that the League had made considerable progress, and was obtaining an increasingly influential membership. Mr. R. M. Leonard having been recently appointed secretary, the offices of the League have been removed to 3, Oxford Court, Cannon Street, London, E.C.

Institution Notes.—Society of Arts.—The Annual General Meeting was held on June 26th, Sir Steuart Colvin Bayley, K.C.S.I., C.I.E., in the chair. H.R.H. the Prince of Wales was re-elected President of the Society, an office which His Royal Highness has filled since 1901. The annual report reviewed the proceedings of the Society during the past session, referred to the award of the Albert Medal to Lord Cromer, and gave a list of the other medals awarded during the session. Amongst the prizes announced for next year is a gold medal under the Benjamin Shaw Trust for Industrial Hygiene, similar medals under the Stock and Mulready Trusts to students of Schools of Art, and one under the Fothergill Trust for the best portable apparatus for use in mines and other places where the air is noxious, enabling men to undertake rescue work. The Annual Conversazione takes place on Tuesday next.

Liverpool and District Electrical Association.—The first meeting of this new Society will be held at the Common Hall, Hackins Hey, Dale Street, at 8 p.m. on Tuesday, July 16th, when the scheme will be explained, and various addresses, &c., will be made. It is intended that the Association shall meet fortnightly, when papers will be read, followed by general discussions; occasionally social evenings will be arranged, when a musical or other suitable programme will be rendered. A series of Saturday afternoon visits to places of interest will also be promoted. The subscription is 10s. 6d. per annum, payable on entry; or in a first installment of 3s., followed by three further payments of 2s. 6d. The Committee extends a cordial invitation to all engaged in electrical work, or other interested persons, to attend the meeting, and any intending members may hand in their names to Mr. S. Frith, the promoter and hon. secretary, 77, St. John's Road, Bootle.

Electrical Coal-Cutting Case.—This prosecution, reported on p. 1038 of our last issue, was continued on June 28th at Dunfermline. Sheriff Shennan delivered a lengthy judgment, imposing a nominal fine of £1, with the alternative of eight days' imprisonment.

British Metallic Filament Lamps.—We are pleased to hear that a large factory for the manufacture of metallic-filament lamps is about to be erected by the Robertson Electric Lamps, Ltd. Details as to the particular kind of filament are not as yet available; but the fact is to be welcomed as a sign that British lamp-makers are awake to the coming change, and do not intend to allow themselves to be left behind in the race. We wish good luck to the new venture.

The Copper Position.—Messrs. Merton & Co.'s fortnightly circular shows an increase in the visible supplies from 11,181 tons to 12,298 tons between June 15th and June 29th, with standard copper at £96 10s. per ton. The extremely artificial conditions of the copper market cannot be better indicated than by reciting the fact that on June 30th, 1906, the visible supplies were 12,275 tons, and the price £80 17s. 6d. The fall from the record prices of £108 10s. per ton on February 28th, and from £104 per ton on April 30th, would be more encouraging to the electrical industry if it were not for the small quantities obtained from the United States. During the month ending June 29th the supplies from North America at London, Liverpool, Swansea and Havre fell to 2,548 tons, a figure never before reached, the average for the year being about 4,430 tons. The supplies to other European ports are also under the average, but not quite at such a dead-water level. The Chilian shipments are, as usual, spasmodic, but a downward tendency in this respect is counterbalanced by the steady increase in the Australian output. The sensitiveness of the market was marked last week by violent changes and by the anticipation of lower prices, which resulted in quotations for three months' delivery at £90 to £91 15s.

Industrial Freedom League.—The annual meeting was to be held at Westminster Palace Hotel yesterday (Thursday), Sir Felix Schuster, Bart., presiding.

A Manchester Scholarship.—The Manchester Education Committee have received an anonymous offer of £50, to provide a research scholarship in the Electrical Engineering Department, provided a like sum be obtained from some other source.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the Devonport Electricity Works on Monday, the borough electrical engineer, Mr. J. W. SPARK was presented, on behalf of the staff and employés with a complete set of table plate in an oak case suitably inscribed. The presentation was made by Mr. W. F. Stamp, the chief assistant engineer, who, in a well-chosen speech, dwelt at length on the cordial relations that had always existed between the engineer and the staff, and wished Mr. and Mrs. Spark every happiness.

On Monday, June 23rd, Mr. F. B. HILLS, assistant engineer at Grantham, who has been appointed engineer for Montrose and Brechin, was presented by the staff with a cut-glass silver-mounted salad bowl and servers. Mr. J. L. ESTHER was also presented with a silver matchbox on the occasion of his leaving to take up an appointment at the Manchester Corporation Electricity Works. Mr. J. E. Edmundson, the engineer and manager, made the presentations. The staffs of the Grantham and Stafford electricity stations went for a trip to Keswick on June 13th.

At Harrogate Electricity Works, on 27th ult., Mr. F. A. PLENDERLEITH, assistant engineer, was presented with a case of cutlery on the occasion of his marriage. The presentation was made by Mr. N. McLean, chief assistant, on behalf of Mr. G. Wilkinson, the borough electrical engineer.

The Electricity Committee of Rotherham T.C. has recommended that the salary of Mr. E. CROSS, borough electrical engineer, be increased from £350 to £400 per annum, as from April 1st last.

The Bolton Electricity Committee has increased the salary of Mr. W. J. WOOD, station superintendent, from £210 to £230.

Mr. T. H. BIRRELL, late chief assistant at the Worcester Electricity Works, has been appointed engineer and manager to the Pontypool E.L. and Power Co.

The Electricity Department of the Marylebone B.C. held their first annual outing at Littlehampton, on Saturday, June 29th, the party numbering over 100, and had a most enjoyable day in excellent weather. Sports were held in the morning, and in a well-contested tug-of-war the Generating Station Team defeated the Mains Department by 2-1. At dinner the chair was taken by Mr. T. R. Richardson (station superintendent), supported by Mr. C. H. Smythe (mains superintendent), and Mr. E. J. Jennings (electrical accountant). The chairman, in a few well-chosen words, expressed his pleasure in seeing so many of the employés present. The pressure at the feeding points was fully maintained, by shutting down on lamb and green peas and running up on sweets and cheese. In the afternoon, motor launch trips to Arundel and brake drives were indulged in.

At a special meeting of the Salford City Council on Wednesday, Mr. HERBERT J. HAWKINS, of Enfield, Middlesex, was appointed deputy borough electrical engineer.

Tramway Officials.—The Maidstone T.C. has appointed Mr. SAUNDERS as manager of the Light Railways undertaking at £160 per annum.

General.—We are informed that Mr. H. E. BRAIN, A.I.E.E., will shortly again be in this country in connection with his business in Buenos Ayres. On the expiration of his agreement with the Buenos Ayres and Pacific Railway, Mr. H. E. Brain has decided to undertake on his own account the carrying out of contracting work in South America. He will combine this with his practice as a consulting engineer. Mr. Brain was for seven years chief electrical engineer to the Buenos Ayres and Pacific Railway, and was responsible for the installation of the electrical plant at Bahia Blanca, both in regard to the electrical equipment at the docks, where there is a most extensive installation of polyphase cranes, and in regard to the lighting of that city. In addition to this scheme, he was responsible for the design, and supervised the manufacture of, the extensions to the direct-current generating station at Junin, and for the equipment of the Buenos Ayres and Pacific Railway Co.'s new carriage and wagon shops at Caseros upon a polyphase system.

The Bury (Lancs.) Education Committee has appointed Mr. FRANK SHAW as instructor in the E.L. and power transmission at the Technical Institute.

Mr. JOHN G. AMES, who was for many years connected with Messrs. R. W. Blackwell & Co., engineers and contractors, of City Road, E.C., as the manager of their Manchester branch, has severed his connection with that firm, and, after visiting the United States, has been appointed manager of the Barrett Manufacturing Co., Spencer House, South Place, Finsbury Pavement, E.C.

From July 1st the name of the firm of Charles H. Merz is altered to MERZ & MCLELLAN.

At Nock's Restaurant, Birmingham, on Thursday evening, June 27th, a complimentary dinner was given by a few friends (chiefly members of the Birmingham Iron Exchange) to Mr. VICTOR DELEBECQUE, A.M.I.E.E, who is leaving Birmingham for Manchester. Mr. Walter Smith presided, and Mr. J. W. Alcock occupied the vice-chair. A presentation was made to Mr. Delebecque, as a mark of personal esteem and goodwill from his Birmingham friends, whose very best wishes he carries with him to the North.

Obituary.—Mr. H. H. HODD.—We deeply regret to record the death of Mr. H. H. Hodd, who died at Darjeeling, India, on June 21st, of enteric fever. Mr. Hodd was an old student of Prof. Ernest Wilson's at King's College, and he was in the employ of the British Westinghouse Co. up to last January, when he was appointed assistant electrical engineer to the East Indian Railway. His untimely death will be regretted by a large circle of friends.

NEW COMPANIES REGISTERED.

"Z" Electric Lamp Syndicate, Ltd. (93,625).—This company was registered on June 5th, with a capital of £36,000 in £1 shares (36,000 "A" and 20,000 "B"), to adopt an agreement with A. Schmitz, H. Pettidier and A. R. Norbert, and to carry on the business of manufacturers and vendors of and dealers in incandescent lamps, and component parts thereof, makers of and dealers in electrical apparatus, fittings and plant, dealers in scientific apparatus and materials, &c. The first subscribers are:—J. G. B. Stone, 9, Drapers' Gardens, E.C., gentleman, 2,000 "B" shares; W. B. M. Bird, 58, Cadogan Place, S.W., solicitor, 1,000 "B" shares; W. H. Cheetham, 20, St. Helens Place, E.C., East India merchant, 2,000 "B" shares; F. R. Reeves, Salisbury House, E.C., engineer, 500 "B" shares; A. W. Hall, Stock Exchange, E.C., stock and share broker, 475 "B" shares; G. Kitchin, Warnford Court, E.C., share dealer, 500 "B" shares; and A. P. Simpson, 2, Princes Street, Bank, E.C., solicitor, 500 "B" shares. No initial public issue. The number of directors is to be three; the first are J. G. B. Stone (chairman), F. R. Reeves and A. R. Norbert. A. R. Norbert is appointed by the holders of the "A" shares, and the said J. G. B. Stone and F. R. Reeves by the holders of the "B" shares. Qualification, £500 shares or stock; remuneration, £100 each per annum (chairman £150). Registered office, 20, St. Helens Place, E.C.

Switch Electric Lamps, Ltd. (93,825).—This company was registered on June 21st, with a capital of £15,000 in £1 shares, to take over, on the terms of an assignment made by Atkinson's Patents, Ltd., certain patents and rights relating to a variable candle-power incandescent lamp, and to carry on the business of manufacturers of electric lamps and patent novelties, &c. The first subscribers (each with one share) are: G. T. Hough, 107, Byron Avenue, East Ham, conveyancer; E. W. Hailes, 170, Engiebrass Road, Catford, S.E., clerk; H. A. Buck, 134, Brixton Road, S.W., clerk; J. Bassett, 82, Burgoyne Road, Harringay, N., gentleman; G. H. Casey, 15, Lawton Road, Leyton, clerk; G. H. Clark, 122, Church Road, Tottenham, clerk; and S. J. Tilly, 47, Crediton Road, Willesden, accountant. No initial public issue. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first, subject to right of Atkinson's Patents, Ltd., to nominate one; qualification of said nominee, two shares; of other directors, 200 shares; remuneration as fixed by the company. Registered office, 14, Devonshire Square, E.C.

Morris-Hawkins, Ltd. (93,821).—This company was registered on June 21st, with a capital of £20,000 in £1 shares (5,000 preference), to carry on the business of electricians, electrical, mechanical, sanitary, gas and water engineers, ironmongers, makers of electric tramcars, motor-cars, aeroplanes, carriages, cycles, vehicles, dynamos, telephones, bells, electroliers, arc and other lamps, electric light fittings and heating and cooking apparatus, &c. The first subscribers (each with one share) are:—J. F. Duncan, 6, Old Jewry, E.C., solicitor; H. A. Bull, Glenluce, Cannon Hill Terrace, Merton, accountant; H. Huntsman, 38, Highbury Park, N., articled clerk; G. A. Duncan, 6, Old Jewry, E.C., articled clerk; W. H. Warwick, 23, Davenport, Road, Catford, S.E., clerk; G. Barnes, 48, Sutherland Street, S.W., clerk; and S. Fennells, 78, Margravine Gardens, West Kensington, W., clerk. No initial public issue. The number of directors is not to be less than three or more than seven; the first are T. Hawkins, W. M. Rolph and H. R. Beddoes; qualification, 1,000 shares; remuneration as fixed by the company. Registered office: 9½, Union Court, Old Broad Street, E.C.

CITY NOTES.

Anglo-Portuguese Telephone Co., Ltd.

Mr. Herbert Allen (Chairman) presided at the offices, 31, Budge Row, on Wednesday, over the twentieth ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, June 28th, page 1055), the Chairman said they would have little cause to be dissatisfied with the progress the accounts showed, whether they regarded them from the standpoint of either gross receipts or net revenue. The estimate of net profit which he gave them a year ago was from £10,000 to £11,000, and in reality it had worked out at £10,696. It would have been better still, but they had charged against profit and loss certain items which they had not in contemplation at that time. They had anticipated by twelve months the stipulations of the debenture trust deed in regard to the sinking fund, and had charged the accounts of 1906 with £1,100 for debenture stock, which they need not have redeemed until 1907. Furthermore, in the past year under review, the entire authorised issue of £50,000 debenture stock ranked for interest, whereas in the previous year only a part of it ranked. The consequence was that they had paid £2,500 for interest last year, as against £2,281 the year before. The increased rate of dividend which they were paying represented a still larger proportion of cash. The 6 per cent. dividend paid last year absorbed only £4,500, because during that year only a part of the authorised capital ranked for dividend, whereas now the 7½ per cent. which was proposed was on the entire issue of £100,000, and therefore absorbed £7,500. Altogether, with the increased shares and debentures, they had paid £4,319 more than for the previous year, whilst again placing £5,000 to reserve and carrying forward a surplus of only £1,803 less than a year ago. This would be the second year in succession that they would have placed £5,000 to reserve, which now stood at the respectable sum of £10,000. They could not expect to continue that indefinitely; and, as a matter of fact, it might not be necessary. It was not placed to reserve for any particular purpose, but there it was, available for any contingency which might arise. They would see that there had been a further expenditure of £8,929 on capital account, and he was happy to say that this heavy outlay (because it was heavy for a small company) was made without encroaching in any way upon the invested funds of the company, which still stood at £10,900. In the current year the capital expenditure might show some diminution, although they had decided to place some of their lines in Lisbon and Oporto underground. This was rather an expensive operation, although one which ultimately redounded to their advantage in every way. They had recently made considerable extensions to their switchboard accommodation in the Central Exchange at Lisbon, which accounted for a considerable proportion of the capital expenditure, but although their subscribers were constantly increasing in number, it was not anticipated that they would have to incur any further very considerable outlay in this respect for some time to come. In proportion to the number of the subscribers, their capital expenditure was very reasonable, and compared favourably with similar undertakings in foreign countries. Their sundry creditors, owing to exceptional circumstances, were unusually heavy on December 31st, particularly in London, but they had been undergoing reduction since that time, and they were at the normal level of about £1,500. They had heard a great deal lately about the political disturbances in Portugal, but the company at all times observed strict neutrality as between the several political parties. In the present state of affairs they saw no particular cause for anxiety, although, of course, further developments might disturb the trade of the country and adversely affect the course of exchange, which, for some time now, had been favourable to undertakings such as theirs. There was one item in the balance-sheet which might not be intelligible to shareholders, which was that of subscriptions received or charged in advance. It was the custom of many telephone companies to credit the year's revenue account with the sum total of subscriptions and rental received. Obviously, however, at the close of every year there must be a large proportion of money received that had not yet been worked off, and for which the company was still liable to render service. Therefore they credited the year's income only with the proportion of the year's subscriptions for which they had actually given service, and so as their business grew this item would become gradually larger and larger. Their relations with the authorities continued to be harmonious, and the public seemed satisfied with the service and with the tariff, while the shareholders got a fair but not unreasonable return on the money they had invested. Altogether, they were gratified with the result of the year's working, and did not look forward to the future with any misgiving.

Mr. F. W. Kerr seconded the motion, which was carried.

An extraordinary general meeting followed for the purpose of making alterations in the articles of association, one alteration giving the company power to extend its operations to any other foreign country.

Mr. Stevens expressed the hope that the directors would not go speculating in other countries, but would leave well alone.

The Chairman explained that they had no desire to do any such thing, but they were close to the border, and it might be advisable to make some slight extensions. The other alteration made clear what the directors' remuneration should be.

The resolutions were carried.

Electrical Power Storage Co., Ltd.

The directors' report to May 31st, 1907, says that the profit for the year, including the balance of £425 brought forward, was £9,176. Out of this £1,000 is carried to the contingent fund, and £2,000 is written off in respect of patents, goodwill, &c. The directors recommend the payment of a dividend of 6 per cent. on the paid-up ordinary share capital, absorbing £5,390, and leaving £787 to be carried forward. The buildings, plant, tools, &c., have been maintained in thorough repair and condition at a cost of £3,597, which sum has been provided out of revenue. Notwithstanding the continuance of the severe competition, as well as the unprecedented rise in the price of raw materials, the company's business has increased during the year under review. The dividend last year was at the same rate.

New General Traction Co., Ltd.

The directors' report for the year ended March 31st, 1907, says that the revenue received and accrued from the various subcompanies amounted to £14,768, but to make a true comparison with the revenue for the 12 months ended March, 1906, which amounted to £14,127, it would be necessary to deduct from the latter amount £2,211, received in 1905 for the Coventry dividend accrued in 1904, thus leaving £11,916 as the income for the year 1906, on which the income for the year 1907 shows an increase of £2,852. The general expenses, including directors' fees and legal charges, amounted to £2,483, as against £1,900 in 1906. The interest on debentures amounted to £12,540 as against £12,614, and interest on loans, £1,836 as against £2,621. The loss for the year amounted to £20,816, which was reduced to £17,241 by the transfer of £3,575 from the special reserve fund. As stated in the circular issued to the shareholders on January 9th, 1907, the lease of the company's Philadelphia undertakings to the Philadelphia Rapid Transit Co. has been duly carried out. No further expenditure will have to be incurred for the Philadelphia undertaking, whilst a revenue of £9,022, gradually increasing to £14,582, will be derived from the securities held by this company therein. The Coventry Co. was showing substantial progress, but, owing to this very fact, further capital expenditure became necessary, and the requisite advances had been made by this company. The Norwich tramways showed no sign of improvement. The returns from the Douglas property had been satisfactory. The directors' reports and accounts of the Norwich, the Coventry and the Douglas Southern Tramway Companies respectively are annexed to the report.

Baron Emile B. D'Erlanger (Chairman) presided over the annual meeting at 20, Bishopsgate Street, on Wednesday. He said that although the item general expenses appeared higher than last year, the directors had been just as careful in husbanding the resources, and the increase was entirely due to legal expenses connected with the various enterprises in which they were interested. The item, "interest on loans," was arrived at by taking the balance of the interest paid by the company on its loans, and interest received by the company from Coventry on the amounts owing by them, banker's interest, &c. This explained why the amount was some £784 less than in the corresponding period, although the amount of loans was larger. The interest on debentures was practically the same as last year, the small difference was owing to the intricacies of the income-tax. They had had to face a loss of £18,741 to carry through the very satisfactory arrangement between the Philadelphia undertaking and the Rapid Transit Co., of Philadelphia. That included two items shown amongst the assets in the 1906 balance-sheet of £5,000 for cars leased to the Philadelphia Co., and £5,884 remittances to Philadelphia up to March, 1906, which, consequently, did not appear as formerly on the credit side of the balance-sheet for the year under review. In addition to those two items, there were further remittances and an ample reserve for contingencies amounting to £7,857, making the loss of £18,741 referred to. They had, however, reduced this loss by the transfer of £3,575 from the special reserve account to £15,166. The dividends they had received from the companies in which they were interested had amounted to £14,768, being, if a true comparison were made with last year, an increase of £2,852; so that on balance they had a loss of £17,241, which, he repeated, was in the main due to the liquidation of the Philadelphia business. The balance-sheet for the year ended March, 1907, presented few changes compared with that of the previous year. The capital and amount of debentures issued and outstanding remained the same. Temporary loans and sundry creditors amounted to £67,426, against £53,535. Passing to the credit side of the balance-sheet, the securities they held amounted to £653,773, against £654,173. The balance standing to the credit of the company on the Coventry extensions account stood at £21,650, against £22,850 last year. The amount appearing of £256 was in respect of additional plant which they were providing at Coventry. The item of sundry debtors, £4,502, consisted for the most part of the Coventry dividend, which, although accrued, was not received before the close of the financial year. Their principal interest was in what was called the Philadelphia undertaking, which was now leased to the Philadelphia Rapid Transit Co.—a corporation of high standing in the

United States, which last year had gross takings of $17,000,000. Under this arrangement the lease was made in such a way that the whole of the bonds which they held in the Philadelphia undertaking were guaranteed at the rate of 4½ per cent., and the shares were guaranteed dividends which rose from 1 per cent. to 5 per cent. in the next four years. The agreement also guaranteed the repayment of the capital sum of the bonds. Therefore it was to be hoped, when the American markets were more normal, that they would be able to realise those securities advantageously. They had received several offers, but preferred to wait, feeling that they could do better. The Coventry tramways, in which they had a very large interest, were doing extremely well, and he had reason to hope that they would get an increased income from them. The only concern which was causing the directors anxiety was the Norwich tramways, which, owing to the depression existing in that part of the world, had shown an appreciable decrease in the takings, and in consequence he saw no hope of the small dividend they were receiving being increased. The other company in which they were interested was the Douglas Southern tramways, which last year did extremely well, and was doing almost as well this year, despite the terrible weather they were experiencing. As he had said, the loss they made last year was £15,000, due, practically, to the adjustment made with regard to the Philadelphian undertaking, and it was a loss which would not occur again. Next year they would start a new leaf, having undertakings which would not require much capital expenditure, and which were giving a revenue; therefore their profit and loss account would be absolutely determined by the amount they received in dividends from the four undertakings, and on the other side there would be the small sum necessary for general expenses and the large sums they had to pay for the debenture interest and for interest on loans.

The Hon. A. G. Brand seconded the motion, which was carried without discussion.

Electric and General Investment Co., Ltd.

The ordinary general meeting of this company was held on Wednesday, June 26th, at Winchester House, Mr. J. B. Braithwaite presiding.

In moving the adoption of the report (see Electrical Review, June 21st, p. 1015) the Chairman, after referring to the loss that the company had sustained in the death of Mr. George Herring who had been connected with the company ever since its formation, said that the total profit of the year was £38,621 as compared with £15,924 last year, which showed a considerable increase. General charges remained about the same, and they had decided to add £20,273 to the contingency fund, bringing that account up to £66,988. They had placed that £20,00) although they intended to pay 22½ per cent. on the ordinary shares and £25 per share on the founders' shares. The investments stood at £246,888 as against £233,494 last year, sundry debtors totalled £18,967 as compared with £20,526, and cash at bankers represented £9,815 as against £7,017. Turning to the other side of the balance-sheet, sundry creditors stood at £15,668 as against £20,992, and the loan account £67,000 as compared with £64 000, and there was a balance on the profits of £6,000 to be distributed as dividends. Dealing with the 17 years that the company had been in operation the Chairman said that the profits, after paying general charges, realised £280,000, and after the payment of the preference dividend there was a balance of £241,235. The amount distributed in dividends on the ordinary shares was £38,827 and on the ordinary founders' shares £141,250, making a total of £180,077 distributed in dividends on all classes of shares, and in addition the trustees of the ordinary shares had received £20,580, making a grand total of £200,657 distributed. The average dividend paid on the ordinary shares was 5s. 7d., or 27½ per cent. as compared with the 22 per cent. they now intended to pay, and the average dividend paid on the founders' shares amounted to £40 0s. 1d. as against the £25 they now intended to declare. With regard to the utility of the company they had raised £12,463,000 to assist electrical undertakings. Perhaps some of the companies assisted had not turned out a great success; but that really was to do with the actual company, for they did not have the power to control the money they raised. He might mention three companies that had been successful. The first, the City of London Electric Lighting Company. They, he thought, had made the best of the money at their disposal, having for several years paid a 6 per cent. dividend, and placed annually £45,000 to reserve; and then there was the London Electric Supply Co., which had paid 5 per cent. on their shares, and placed a considerable amount to reserve. Thirdly, there was the British Electric Traction Co. That company, in spite of adverse conditions in various ways—people clamouring to be carried for next to nothing, and having been harrassed by local authorities, managed to perform a public service. Last year 300 million passengers were carried. Although they paid no dividend on the ordinary shares, they managed to pay one on the preference shares, and placed £50,000 to reserve, and he thought the shares on the market were unduly depreciated. They had over £1,600,000, which had been expended in various undertakings, which had not yet produced an appreciable return. As the directors of the B.E.T. Co. pointed out in their report, a difference only of one-sixth of a penny per car-mile would mean an addition of £200,000 to the revenue of the company, and when they remembered that it required £13,000 to pay a 1 per cent. dividend, they would see what that £200,000 meant. The £1,600,000 which was invested by the company would mean £64,000 to the revenue of the company if the companies they were interested in paid a 4 per cent. dividend; and taking the £200,000 already referred to, they would see that the company would thereby enter the ranks of the 7 per cent. dividend-paying companies. He, therefore, thought the B.E.T. Co. had a very bright outlook. They had that morning heard that the Select Committee of Parliament had thrown out the Bill promoted by the L.C.C. for the supply of electricity, and maybe they would now be left in peace for a time. As soon as the public realised the inconvenience that local authorities caused by harrassing private enterprise, then would the company be able to work unmolested. From the speeches of Mr. Lloyd-George it was evident that he, as representing the Board of Trade, was cognizant that it was impossible to go on carrying passengers at a loss. He (the speaker) thought it was far better that a man should pay a 1½d. fare to go to his work than a 1d. and have no work to go to. For in course of time, if electrical companies were harrassed by local authorities, &c., capitalists would not launch out into any new enterprises, and thus schemes would become dormant. On the whole, he thought there was a bright, a better outlook for electrical companies during the coming years than there was four or five years ago.

Mr. E. Garcke seconded the motion, and the report was adopted.

The Chairman, in accordance with the notice that had been sent with the report, explained that it was proposed to reconstruct the company in order that the founders' shares might be extinguished, and that additional capital might be raised in order to cope with the increasing and profitable business of the company. It was probable that the company, when reconstructed, might be able to acquire, on terms which would prove advantageous to the company, a large amount of the electrical securities held by the late Mr. George Herring. The Board had, however, been approached by an influential body of shareholders holding founders' shares during the last few days, and they had stated that they did not consider the present time opportune for reconstructing the company. He (the Chairman) thought that a resolution for reconstructing the company should be carried unanimously, and therefore he proposed that the extraordinary general meeting called for considering the question of reconstructing the company be adjourned *sine die*.

Mr. E. Garcke seconded the motion with, he said, great regret, because the scheme had received every consideration, and he had hoped that the resolution would have been passed unanimously.

An amendment was proposed by Mr. Croft, a shareholder, and seconded by another shareholder, that the meeting should be adjourned for three months.

After some further discussion, the amendment was declared carried.

The British Electric Traction Co., Ltd.

This company's meeting was held on Thursday, June 27th, at Salisbury House, E.C., Sir C. Rivers Wilson presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, June 21st, page 1015) said that the gross profits of all the associated undertakings, after debiting expenses, but before charging interest on capital, or loans, or rental of leased lines, had increased from £464,000 in 1905, to £539,000 last year, an increase of over £75,000. The increase which the B.E.T. Co. had received in respect of dividends was £9,273, notwithstanding the fact that the Brush Co. which, in 1905, gave them a return of £3,711 in the way of dividends, paid them nothing last year. In addition to paying increased dividends, which, of course, did not all come to the B.E.T. Co., the various companies had applied over £40,000 more than in the previous year, to writing off depreciation and adding to reserves. The amount written off for the year just expired was £176,000, as against £132,000 in 1905. The list of investments upon which revenue had been earned had been increased by £169,000. Of that amount £135,720 was included in the unremunerative list in the previous year. On the other hand, unremunerative investments had been increased by shares of the cost value of £405,000. That included their holding of £220,000 in the Brush Co., which he hoped would very soon return to its former place as a remunerative investment. The other unremunerative investments need not be regarded with apprehension, because they were, for the most part, in undertakings which were only in the initial stages of their existence. The prominent aspect of the position of the company's business which was forced upon them was that they were not obtaining a sufficient net profit, or one which was commensurate with the services which they rendered to the public. Their various undertakings carried during the past year 333 millions of passengers, and the gross receipts were only about 1½ million sterling, or 1·5d. per passenger. The travelling facilities now offered to the public by the electric car were immensely superior in point of comfort to horse and other tramcars which preceded them. On their Metropolitan system they were carrying ordinary passengers 2½ miles for 1d., and working people had the privilege of travelling as much as five miles for 1d. He had never been able to understand the difference which philanthrophists had chosen to establish between what were called the working men and other classes who to his (the speaker's) mind ought equally to be so regarded—he referred to the poor seamstress or the poor clerk. Owing to the large number of tramway undertakings in the country being in the hands of the local authorities—two-thirds of the whole tramway mileage being so worked as compared with about one-third before the introduction of electric traction, there had been a never-ceasing agitation for a reduction of fares. Their fares were not so low as some of those charged by local authorities, but nevertheless they were too low having regard to the character of the districts which they served, as well as the heavy capital outlay which had been necessary in adopting electric traction. If they had only last year received the same fare per passenger as they received six years ago, their associated companies would have made £200,000 more profit, which would have been largely available for improving the dividend on the ordinary shares,

the bulk of which was held by the B.E.T. Co. A stand must be made against this perpetual clamour for reduction of fares and increased distances. That view was now being taken even by municipalities. At Glasgow, where halfpenny fares had been in operation for several years, there had notwithstanding been recurring agitations for further concessions, and a report had lately been issued by the general manager of the tramways in which he stated that the only safe course for the Corporation to adopt was to absolutely refuse to make any further reductions in fares. There was a time, not so very long ago, when it was expected as a matter of course that the industries of this country should be conducted upon business lines. That had been the state of things in the past, and the interests of the country had flourished under it. But those ideas appeared to have gone out of fashion with certain politicians and pseudo-philanthropists, who had made the transport industry the special subject of their socialistic experiments, and who contended that they should be conducted upon altogether different principles to those which had ruled in the past—if they could call principles what really were the very negation of principle. They would impose upon shareholders of undertakings created at great cost and considerable risk for the performance of useful public service, obligations to carry on that service at less than cost price; while at the same time it was expected that facilities should be continually improved, that additional conveniences should be supplied, and all this at the expense of the very shareholders whose power to supply this extra accommodation they were crippling and destroying. A great many of these shareholders were only men of moderate means, who depended for their livelihood in a great measure upon their investments in these undertakings, and who naturally thought that they would be conducted upon ordinary business principles, without unfair outside interference. Surely the time had now come when it must be recognised that this industry was to be worked upon a commercial basis, and the public, who, he thought, generally took a fair and honest view of things when they thoroughly understood the question would, he felt confident, sympathise with the movement of the traffic companies for obtaining more equitable treatment in order that they might obtain a fair, but not an unreasonable, return for their investments in those useful undertakings. It was, indeed, refreshing to read the remarks of the President of the Board of Trade upon the occasion of the opening of the last of the tube railway, when he said that it was not to the interests of the public that those concerns should be run at a loss. Those were very encouraging words, and he hoped that Mr. Lloyd-George would see his way to translate them into acts. As a matter of fact, the electric tramway industry had received but scant support from the department over which Mr. Lloyd-George presided. He was well aware of the difficulties of the President of the Board of Trade—with his enfeebled authority he was not able to stand up against those hostile interests from which they were now suffering; but was it not strange that in England, of all countries of the world, we should have a Minister who was in charge of the vast interests of the trade and commerce of the country relegated to a position of inferiority in the Cabinet. The present Government was a reforming and progressive one, and if Mr. Lloyd-George were to use his influence to get the Government to appoint a Minister of Commerce, he believed he would be applauded by the country, and it would give greater satisfaction to the mercantile community than would other so-called reforms which the Government were now contemplating. Unfair comparisons had frequently been made as regarded the success which had attended tramways in large cities worked by the municipalties and the smaller enterprises in which the B.E.T. Co. were more particularly concerned. A few years ago the Birmingham people decided to municipalise their tramways because the offer which was made by the B.E.T. Co. was not thought to be good enough. The accounts of the tramway undertaking for the past year had just been published, and they showed a surplus available for reduction of rates of about £12,000. Had, however, the Corporation left the tramways in the hands of the company they would have been receiving an annual profit of three or four times that amount. Then there was the case of Wolverhampton, which in 1901 decided to break up the system, of which that town formed only a part. The chairman of the Corporation estimated a profit of £4,500 a year; but in 1903 he warned the public not to expect any contribution in aid of the rates for some years, as the Tramway Committee would put the profit to reserve, and in 1906 there was a deficit of over £3,000. Those cases might be multiplied, illustrating how the tramway business of this country had been frequently broken up and spoiled as a result of the anxiety of municipalities to undertake the business. It was only fair to say that there had been growing up and there was to-day a more tolerant spirit among corporations, and a case in point was Croydon, where they had been able to secure through running arrangements. With regard to the Brush Co., last year for the first time they received a very satisfactory dividend in respect to their holdings in that company, but this year, as he had already said, they had not received anything. The causes of that untoward state of things was very clearly stated by the chairman of that company at its recent meeting. As to their own company, this year for the first time they were unable to recommend the payment of any dividend on the ordinary shares. The foreground of their hopes n the future lay in an increase of fares, and that had already taken effect in several instances. Most of the companies were working under Acts and orders which prescribed the maximum fare which might be charged, but which in practice had not been charged hitherto. Upon the whole, they had every reason to anticipate a considerable increase in revenue under that head. The prospects of some of the companies in which they had the largest holdings were particularly encouraging. They had over £300,000 in the Metropolitan Electric Tramways, which last year paid them 4 per cent. as against 3 per cent. in 1905. That company had 29½ miles in operation, and 6 more miles would be opened this year. The number of passengers carried increased from under 129 millions in 1905 to over 136 millions, and the average receipts per car-mile were increasing. That company held a very large interest in the North Metropolitan Electric Power Supply Co., Ltd., the prospects of which were very encouraging. A very hopeful point in the future of that company was the great potentiality of the supply of power in bulk. The South Metropolitan was another very important undertaking in which the B.E.T. Co. held about £239,000 out of a total share capital of £400,000, and they hoped that very shortly that company would emerge from the category of non-remunerative investments. It had been suggested by some of their critics that, because they had been reducing the dividends on their ordinary shares and this year had not paid anything, that there was a probability that they would not pay the full preference dividend next year. He begged to say that there was no real cause for anxiety on that account. They were carrying forward £13,000, and also about £42,000 of the Bombay profits, making £55,000, and there was every reason to hope that the dividends on their investments would continue to increase, so that there need be no misgiving whatever in regard to the ability of the company to pay its preference dividends. In conclusion, the chairman referred with regret to the loss the company had sustained in the death of Mr. George Herring, who, he said, was not only one of the largest holders in the company, but was one of the promoters, and who, since the formation of the company in 1895, had always given it the benefit of his advice and assistance.

Mr. Emile Garcke seconded the motion, which was adopted after a short discussion.

Rubber Companies.

Java Rubber and Produce Co., Ltd.—The annual meeting is to be held on July 9th. The Castilloa rubber trees number 27,000, of which 15,000 range from four to eight years old, and the Para or Hevea trees number 120,000, of which 15,980 are between one and two years old, the rest being last year's planting. During the current year 262 acres of forest are being cleared and planted with Para rubber.

Perak Rubber Plantations, Ltd.—The report to March 31st says that of the trees planted, 12,600 have been tapped, or about one-sixth of the total, and the general expenditure on the estate, including superintendence, has been apportioned accordingly. During the year a further 170 acres have been felled and cleared. The work of the estate has been seriously handicapped during the year by sickness among the labour force. Matters in this respect have, however, greatly improved, and the latest reports received are quite satisfactory. 16,327 lbs. of dry rubber were harvested and sold for an average price of 4s. 10d. per lb. The estimate for this year is 30,000 lbs. The net amount at credit of profit and loss was £1,014, which was carried forward.

Vallambrosa Rubber Co.—The profit on working for the year ended March 31st was £30,240. The dividend for the year is 55 per cent. £6,749 is carried forward. It is reported that the year's output of rubber from Vallambrosa was 156,922 lb., against an original estimate of 100,000 lb., which was subsequently reduced to 120,000 lb. At Buket Kraiong it was expected that 320 acres would be planted by the end of June at a cost of about $73.50.

Langkon North Borneo Rubber, Ltd.—The report to March, 1907, says that at that date the area cleared was about 600 acres, of which 462 acres were planted with 85,500 para rubber trees. A telegram from the manager, received on 4th ultimo, said that the area planted was then 502 acres representing 93,000 trees. The 4 per cent. dividend guaranteed, for six years, by the North Borneo Co., under the terms of the concession, has been duly paid to date. The meeting was held on July 1st, Col. Sir A. FitzGeorge presiding. He said that the last telegram received by the directors informed them that the total number of trees planted was 104,000. This was a little better than they had expected, and the bulk of the trees were in good order. As far as they could see, indiarubber was proving to be a very fine industry in North Borneo. The demand for rubber did not decrease; in fact, he should say that it increased, and they had not heard of any successful invention to take its place.

Galvez Rubber Estates, Ltd.—The statutory meeting was held recently, Mr. Frank Newnes, M.P., presiding.

Pelmadulla Rubber Co., Ltd.—Sir Alex. Wilson presided at the second annual meeting on June 21st. He said that they now possessed 1,185 acres planted with rubber, and by the end of the current year he believed the area under cultivation would be made up to 1,700 acres. Owing to the congestion in the various departments of the Government in the island of Ceylon they had not yet obtained the legal conveyance of their land, but they expected that to be made over to the company very shortly. Mr. H. K. Rutherford, in seconding, said that while in Ceylon early in the year he visited both the Pelmadulla and the Geranga Estates. With regard to the latter estate, last year they were unfortunate in having a most unfavourable season, both as regarded the yield and the price. In the present year, however, they were ahead of the output of last year by 60,000 lb, and the price was 1¼d. per pound more; so that the present position was distinctly encouraging for the current year. The rubber trees on the Pelmadulla Estate were growing exceedingly well. A dividend of 4 per cent was declared.

Kepitigalla Rubber Estates, Ltd.—The first annual meeting was held on June 28th, Mr. C. Williamson Milne presiding. The Chairman said that of the 3,414 acres owned by the company, 3,214 were now under cultivation, and of that amount 784 acres had been opened up during the period covered by the accounts. That was considerably more than they had contemplated opening up at

the time when the prospectus was issued, and it accounted in a great measure for the increase of £2,000 shown in the balance-sheet under the heading of development of the estates. The yield of rubber from the estates and the price at which it had been sold could only be considered as satisfactory, and was a very high average price. A very large number of trees—119,000—would be three years old in August and September of this year, and 219,000 would be two years old in November and December next. He could not tell them how many of these trees were planted from seed, and how many were planted with stumps from the nurseries. The chairman said that he had been looking into statistics and he found that the world's consumption of rubber in 1900 was approximately 50,000 tons, and at that time rubber realised from 3s. 6d. to 4s. 6d. per lb. He was speaking of Para rubber. In 1906, as nearly as he could ascertain, the world's consumption of rubber was some 65,000 tons, an enormous increase in the short period of six years, and yet they found that the price of Para rubber last year averaged from 5s. to 5s. 5d. per lb. while during the same period last year plantation or cultivated Para rubber averaged 5s. 4½d. to 6s. 3½d. per lb. "There was a considerable drop in the price of Para rubber recently, while to-day the price is below the average of last year. So far as I can ascertain this is largely due to the fact that a very considerable quantity of rubber came down the Amazon, and was put on the market at a time when the market was congested with a pretty considerable supply. That cause was purely temporary. The rubber had been harvested in the interior, but there had not been facilities for sending it to market. I am told that this happens periodically so far as Brazilian rubber is concerned, and naturally for the time being it affects the market. Those who fear that the price of rubber is going to suffer a very material drop in the next two or three years may take it, I think, that their fears are groundless. My belief is that rubber, although it may not maintain the high prices which it reached last year, will maintain a price which will enable the shareholders in companies which have producing plantations to earn very handsome dividends in the future."

Sungei Kopar Rubber Co., Ltd.—The annual meeting was held at Edinburgh on June 24th. The report stated that at December, 1906, the whole of the Sungei Kapar estate, having an area of 1,330 odd acres, had been planted with Para rubber, and contained approximately 190,000 trees of various ages, none of which, however, had at that date come to the producing stage. Tapping had been commenced with satisfactory results on 199 acres planted in 1902. The trees were yielding very well, and the quality of the rubber was good. The yield of rubber from this estate for 1907 was estimated at 10,000 to 15,000 lb. The Brafferton estate, which contained 1,083 acres, was as yet only at an early state of development, about 65 acres having been cleared and planted with rubber. The directors hope to have cleared and planted a further 300 acres before the close of the current year.

Federated (Selangor) Rubber Co., Ltd.—The annual meeting was held on July 1st. Mr. H. K. Rutherford, who presided, said that they had harvested 7,325 lb. of rubber, as against 1,945 in the previous year. They would have over 50,000 trees in the bearing stage next year, and would soon be able to place the company on the dividend-paying list. Last year their rubber realised £1,474. There were 112,213 rubber trees on the property. They were gradually removing their coffee in order that the rubber trees should grow more freely. It was hoped to bring their present estate of 1,012 acres of rubber, equipped with factory and machinery, into full bearing for £20 per acre. He had no fear of the yield and the cost of production, but it was impossible to predict what prices were likely to be in the future.

J. G. White & Co., Ltd.

The meeting of this company was held on Friday last, at 9, Cloak Lane, Lord Arthur Butler presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, June 28th, p. 1055), said it gave him great pleasure to preside at that meeting, and to meet them once again with a favourable report showing that good progress had been made by the company since they were last called together. The year's profits, which had been arrived at on the usual conservative basis, were nearly £5,000 in excess of the previous year's result, and the company had a large amount of satisfactory contract work in hand which would enable them to present a favourable report to them when they met next year. It might not be out of place there to revert to what the company had accomplished during its existence. The total profits earned up to February, 1907, aggregated £142,859, which gave an average annual profit for the 6½ years of nearly £22,000. The dividends distributed, including those now recommended to be paid, amounted in the case of the preference shares to 45 per cent. of the subscribed capital, and in the case of the ordinary shares to 39 per cent., no dividend being paid on the ordinary shares for the first year of the company's trading. The average annual distribution on both classes of shares had been slightly in excess of 7 per cent. per annum. During the same period the company had set aside out of profits to reserve fund the sum of £60,000, and would still, if the report were adopted, be in the happy position of carrying forward to next year's accounts the sum of £18,312, which was more than sufficient to cover a full year's dividend on both classes of shares. Those results were extremely gratifying. In recommending a distribution on both classes of shares of 7 per cent. for the year the directors were bearing in mind the advantage to be gained in maintaining the same average rate of dividend as had been paid in the past, and the policy pursued of adding largely to the reserve and increasing the amount carried forward, would undoubtedly strengthen the shareholders' position as regards future dividends, and would guard against the results of fluctuation in profits. In conclusion, he moved the adoption of the report and the payment of dividends and bonus.

This was adopted, and the retiring directors and auditors were re-elected.

City of London Electric Lighting Co., Ltd.—The directors have declared the following dividends on account of the distribution for the year ending December 31st, 1907:—On the preference shares 6s. per share (being at the full rate of 6 per cent. per annum), and on the ordinary shares 5s. per share (being at the rate of 5 per cent. per annum), both for the half-year ended June 30th, 1907. The dividends are subject to the deduction of income-tax, and will be payable on or after July 17th. Last year the ordinary dividend for the corresponding period was at the same rate.

Edwards Air Pump Syndicate, Ltd.—Interim dividend for the first half of the year 1907 at the rate of 10 per cent. per annum.

Cryselco, Ltd.—We are informed that the ninth annual general meeting of shareholders was held at the Kempston Works, Bedford on June 24th, when, after placing the usual amount to reserve, a dividend of 10 per cent. was declared, and the balance of £3,217 carried forward.

Vickers, Sons & Maxim.—The directors announce an interim dividend for the half-year ended June 30th of 1s. per ordinary share.

British Westinghouse Co.—The petition of this company for reduction of capital by £1,375,000, in accordance with resolutions passed at the last annual meeting, was sanctioned by the Court on Tuesday by Mr. Justice Neville. His Lordship directed that the company should use the words "and reduced," for the period of six months altogether.

Typewriting Telegraph Corporation, Ltd.—Mr. A. J. Parker presided at the ordinary meeting of this company, held at Great Eastern Hotel, E.C., on 28th ult. In the course of his speech moving the adoption of the report, he said that a large number of the Steljes recorders had been installed in the new Liverpool Cotton Exchange. Some of their latest type of instruments (the Teletyper) had been sent out to Egypt for demonstration before the Government authorities. The apparatus was also earning a good position in Switzerland with the Government.

Stock Exchange Notice.—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Electric Traction Co. of Hong-Kong, Ltd.—£195,000 5 per cent. mortgage debentures of £100 each, Nos. 1 to 1,950 (registered).

Fort William Electric Lighting Co.—The directors recommend a dividend of 2½ per cent.

Prospectuses.—*Lancashire Dynamo and Motor Co., Ltd.*—This company has this week been offering for public subscription an issue of £50,000 5 per cent. first mortgage debentures. The purposes of the issue are: To pay off overdraft with bankers and certain temporary loans, and to supply additional working capital which is now required.

Platinum Corporation, Ltd.—An issue of 297,500 ordinary shares of £1 each and 14,875 deferred shares of 1s. each have this week been offered for subscription.

Official Announcement re Companies.—The following companies are to be struck off the register within three months unless cause is shown to the contrary:—

Britannia Electric Carriage Syndicate, Ltd.
Electric Heating Corporation, Ltd.
Manufacturing Electric Co., Ltd.
Miniature Arc Lamps, Ltd.
Perfect Dry Seat Syndicate, Ltd.
Suspended Electric Railway Co., Ltd.
Zea Arc Lamps Co., Ltd.

STOCKS AND SHARES.

Tuesday Evening.

Before presenting our usual half-yearly tables of quotations and comparisons, the remarkable [because so negative] attitude of the electricity supply market to the situation created by the rejection of the L.C.C. Bill demands at least a passing notice. Prices of shares in the London companies have barely moved a penny at this removal of the market's greatest bugbear, and no greater proof could be adduced, were proof needed, to evidence the public's mistrust of this department. Half-a-dozen brokers asked for lists of the best shares to buy, as many clients studied those lists. And there, for practical purposes, the matter ended, for purchasers did not come in, and prices remained as they were before the rejection was known. The impression in the market is that possible buyers

are restrained by the fear that the scheme is only postponed, not scotched for good, and that even if the L.C.C. fail to get the monopoly of a central station for supplying all London with electric power, that some other monopolists may be successful, and that the Bill of the companies themselves has not much chance of being passed.

Passing to a review of the prices during the first half of 1907, the chief feature of melancholy interest is the flatness of Edmundson's shares on the passing of the Preference dividend. Other prices in the list are mostly lower, Bromptons standing out as a bright exception. The declaration of the City of London dividend has made no difference to the quotation. These are the principal supply companies' shares, showing the fluctuations that have occurred in the six months:—

Ordinary Shares.	Dec. 31, 1906.	Now.	Rise or Fall.	1907. Highest.	1907. Lowest.
Brompton and Kensington	7⅞	8½	+ ⅛	8⅝	7⅞
Charing Cross	3¼	3⅜	— ⅛	4⅛	3⅛
City of London	10	9½	— ⅜	10⅞	9½
County of London	8	8	—	9	7⅝
Edmundson's	3	3	— 2½	3	3
,, Preference	5	2	— 3	5	1⅞
Metropolitan	7⅛	6½	— 1⅛	8	5⅛
Notting Hill	14	12½	— 1½	14	12½
St. James'	10	8½	— 1½	9⅞	7⅞
Urban	3⅜	1½	— 1⅞	3½	1⅛
Westminster	9½	9½	—	10½	9

Next in importance comes the little list of railway stocks identified with electrification. Here the record of falls makes a miserable showing, except as regards City and South London Ordinary stock, which advanced 4 points, equal to nearly 10 per cent. during the period. The fall of 27½ in the 5 per cent. Profit-sharing Notes of the Underground Electric Railways Company of London deserves to be pondered in conjunction with Sir Edgar Speyer's kind invitation to the municipalities to take a hand in tube enterprises.

Stock.	Dec. 31, 1906.	June 29, 1907.	Fall.	1907. Highest.	1907. Lowest.
Central London Ordinary	83	74	9	83	68
,, ,, Deferred	73½	54½	19	73	51
City and South London	42	46	+4	46	39
Great Northern and City Pref.	3½	2½	1½	3⅜	2½
Metropolitan	60	44½	15½	60½	37½
Metropolitan District	19	12	7	19½	10
Underground E.R. Profit Notes	90	62½	27½	90	62½

When we arrive at the telegraph list, the comparative immunity of the investment stocks from severe depreciation is the obvious feature. The drop in Anglo-American Telegraph Deferred is a speculator's affair, the price having been unduly inflated last December. We add two stocks of the National Telephone Company.

Stock or share.	Dec. 31, 1906.	Now.	Rise or fall.	1907. Highest.	1907. Lowest.
Anglo Preferred	109	108	— 1	112⅞	105
,, Deferred	27⅞	19⅜	— 8½	28⅝	18⅜
Cuba Submarine	8⅜	8	— ⅜	8⅜	8
Direct U.S.	15⅞	16	+ ⅛	16½	14⅜
Eastern Extension	13⅜	13¼	— ¼	14⅛	13
Eastern Telegraph	136½	137½	+ 1	142¼	136½
Great Northern	36½	35	— 1½	39	33½
Indo-European	59	57	— 2	60½	56½
Western Telegraph	13⅜	13⅝	+ ⅜	14⅛	13⅛
National Telephone Preferred	108	109	+ 1	111½	105½
,, ,, Deferred	106½	107	+ ½	112½	101

Tramway movements are somewhat uninteresting, apart from the slump in British Electric Tractions. Rumour was very busy during the half-year with various schemes for unification of the Argentine group, and the publication the other day of a scheme whereby the Anglo-Argentine and the Belgrano systems become practically merged has improved prices in this section. Appended are a few comparisons:—

Stock or share.	Dec. 31, 1906.	Now.	Rise or Fall.	1907. Highest.	1907. Lowest.
Anglo-Argentine Ordinary	7⅛	8⅛	+ ⅛	8⅝	7⅛
British Columbia Electric Def.	129½	122½	— 7	135	123
British Elec. Traction Ordinary	4⅜	3	— 1⅜	4⅜	3
,, ,, ,, Preference	8½	7½	— 1⅛	8⅞	6½
Cape Electric	2	2	—	2	2
London United Preference	8¼	8¼	— ⅛	9⅛	7⅞
Metropolitan Electric Tram Pref.	8⅞	8⅝	+ ⅛	9⅛	8⅝

Business in the electrical manufacturing world cannot be said to have boomed in the first half of 1907. And this state of affairs finds reflection in the price lists. The fall in British Westinghouse Debenture stocks stands out prominently. Telegraph companies have maintained their levels very well, as the table shows:—

Stock or share.	Dec. 31, 1906.	Now.	Rise or fall.	1907. Highest.	1907. Lowest.
Babcock & Wilcox	4	3⅞	— ⅛	4⅛	3⅞
British Insulated	6⅞	6⅞	— ⅛	7⅛	6⅞
Brush Ordinary	3	3	—	3	3
British Westinghouse Preference	1⅞	1½	— ⅜	1⅞	1⅜
,, ,, Debenture	73	59⅜	—13⅝	73	65
Callender's	10	10	—	11⅛	9½
Electric Construction	⅞	⅞	—	⅞	⅝
Edison & Swan	1⅛	1⅛	— ⅛	1⅛	1
Henley's	11½	12	+ ½	13	11⅛
India-Rubber	16½	15½	— 1	16½	15
Telegraph Construction	31	31½	+ ½	32½	29

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	June 26	2,935	+ 65	4	5,359	— 257	14·4	..
Ayr	,, 29	670	— 21	7	1,342	— 140	8	..
Bath	,, 26	1,690	— 2	26	19,201	— 56	13	..
Belfast	,, 28	7,420	+ 639	13	46,702	+ 2,726	40	..
Birkenhead	,, 30	2,104	— 50	13	13,855	— 550	13·52	..
Birmingham Corp.	,, 29	12,144	..	13	77,238	..	56·15	..
Blackburn	,, 26	2,056	— 56	13	14,777	+ 624	14·13	..
Blackpool Corp.	,, 27	1,925	— 310	..	11,118	— 1,709	11·87	..
,, —Fleetw'd.	,, 29	1,304	— 316	25	10,342	— 441	8·25	..
Bolton	,, 30	2,531	+ 175	26	29,283	+ 871	26	..
Bournemouth	,, 26	3,104	— 84	12⅔	20,583	— 124	21·5	2½
Bradford	,, 29	9,249	— 159	13	60,056	— 319	53	..
Brighton	,, 30	1,773	— 302	13	11,453	— 1,155	9·5	..
Bristol	,, 28	10,056	— 308	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	,, 21	449	— 14	24	5,394	— 7	3·65	..
Barnsley	,, 21	986	+ 70	,,	3,965	— 12	..	..
Barrow	,, 21	527	— 37	,,	5,646	— 91	5·37	..
Cavehill	,, 21	186	— 48	,,	1,815	— 33	..	..
Devonport	,, 21	900	+ 2	,,	10,747	+ 68	8·85	..
Gateshead	,, 21	2,000	+ 120	,,	23,908	+ 843	11·25	..
Gravesend	,, 21	603	— 13	,,	5,570	+ 48	6·5	..
Greenock	,, 21	1,379	— 237	,,	15,518	— 149	7·25	..
Hartlepool	,, 21	681	+ 32	,,	6,420	— 854	6·72	..
Kidderminster	,, 21	237	+ 15	,,	2,628	— 114	..	..
Leamington	,, 21	321	73	,,	3,579	— 287	3	..
Merthyr	,, 21	411	+ 24	,,	4,979	+ 255	2·9	..
‡Metropolitan	,, 21	10,241	+2,633	,,	103,479	+23,408	29	..
Middleton	,, 21	720	— 262	,,	8,212	— 84	8·5	..
Mid. Joint Com'tee	,, 21	11,558	+ 395	,,	137,138	+ 1,655	..	..
Oldham — Ashton	,, 21	1,193	— 60	,,	14,352	+ 732	9·13	..
Peterborough	,, 21	242	— 16	,,	2,772	— 56	5·31	..
Potteries	,, 21	3,757	+ 306	,,	45,014	+ 1,091	29	..
Rothesay	,, 21	508	— 233	,,	2,737	— 318	2·75	..
Southport	,, 21	621	— 179	,,	6,411	..	8·17	..
S. Metropolitan	,, 21	1,655	+ 852	,,	17,756	+ 997	..	..
Swansea	,, 21	1,765	+ 45	,,	20,058	+ 500	5·5	..
Tynemouth	,, 21	539	— 55	,,	4,540	— 656	3·75	..
Weston-s-Mare	,, 19	272	— 144	,,	1,728	— 174	3	..
‡Worcester	,, 21	586	— 15	,,	6,269	— 156	5·75	..
Wrexham	,, 21	212	+ 6	,,	2,379	— 28	..	..
Yorks. Wool. Dist.	,, 21	2,035	+ 62	,,	22,824	+ 129	17	..
Miscellaneous	,, 21	462	— 7	,,	5,076	— 114	..	..
Burnley	,, 29	2,435	+ 73	..	..	..	7·5	..
Burton-on-Trent	,, 30	585	— 39	13	3,764	— 261	10	1·5
Bury	,, 23	2,218	..	12	12,577	..	10·5	..
Cardiff	,, 29	4,290	— 45	13	26,912	— 49	15·87	..
Carlisle	,, 30	374	— 24	26	4,166	— 350	..	..
Chatham and Dist.	,, 27	1,550	+ 235	26	17,438	+ 1,403	12·84	2·55
Cork	,, 27	1,024	— 58	24	11,291	— 406	8·89	..
Croydon	,, 28	2,920	— 229	13	18,329	— 1,346	12	·75
Darlington	,, 22	225	+ 13	12	2,587	+ 16	..	..
Darwen	,, 28	586	+ 28	13	3,313	— 12	4·36	..
Dover	,, 29	460	— 114	13	2,860	— 366	4·75	..
Dublin	,, 28	13,025	+1,762	22	133,671	+ 9,015	54·2	5·5
Dundee	,, 12	2,236	— 24	4	4,470	+ 129	13	·5
East Ham	,, 29	1,860	— 78	13	11,825	— 406	8	..
Exeter	,, 28	640	— 39	13	4,000	+ 323	4·75	·5
Glasgow	,, 29	35,960	+1,209	4	74,909	— 2,918	89·75	9·5
Hastings	,, 27	1,997	..	..	..	..	..	..
Huddersfield	,, 22	1,606	+ 76	12	19,002	+ 650	28	..
Hull	,, 29	4,869	+ 284	13	30,860	+ 1,735	18	..
Ilkeston	,, 25	283	+ 7	13	1,835	+ 147	3·5	..
Ipswich	,, 29	842	— 114	13	5,078	— 465	10·5	..
Isle of Thanet	,, 29	1,556	— 149	26	10,061	— 113	11	..
Kilmarnock	,, 29	307	— 6	6	1,652	+ 18	4·25	..
Lan'kshire Trm. Co.	,, 27	2,460	+ 671	26	28,422	+ 6,142	15·22	3·26
Lancashire United	,, 26	3,168	+ 738	26	30,734	+ 8,421	8·5	10·5
Leeds	,, 29	13,374	+ 789	13	84,210	+ 3,408	96	6·5
Leicester	,, 29	4,661	— 142	..	..	..	..	..
Leith	,, 29	1,060	— 2	6¾	3,437	— 77	6	..
Liverpool	,, 22	22,248	+ 851	25	234,914	+ 8,579	104	..
‡L.C.C.	,, 22	35,181	+11,767	13	369,801	+55,556	116½	17½
London United	,, 28	14,203	— 264	22	154,161	+ 2,643	..	..
Lowestoft	,, 29	454	+ 28	59	6,246	+ 885	3·7	..
Manchester	,, 29	29,877	+2,324	13	189,170	+15,350	172	21
Newcastle	,, 29	10,759	+ 884	..	55,149	+ 1,427	..	..
Newport	,, 29	1,268	— 19	13	9,617	+ 1,397	14·5	..
Northampton	,, 28	867	— 37	12⅝	5,540	— 263	5·5	..
Oldham	,, 30	3,753	+ 104	14	26,792	+ 1,757	23·72	..
Pontypridd	,, 29	518	+ 202	13	3,462	+ 1,194	5	1·75
Portsmouth	,, 24	4,225	— 16	13	24,948	— 786	14·5	..
Preston	,, 26	1,528	— 38	..	..	..	..	..
Reading	,, 27	1,280	— 90	12½	7,753	— 270	13·25	..
Rotherham	,, 27	1,185	+ 284	12⅞	7,461	+ 1,104	10	·66
Salford	July 1	9,306	+ 74	13	61,495	+ 1,134	38·9	..
Sheffield	June 30	10,248	+ 532	13	77,021	+ 3,269	35·76	..
Southampton	,, 26	2,043	+ 31	12⅝	12,353	+ 346	..	..
Southend-on-Sea	,, 26	791	— 55	13	4,427	— 254	..	..
Sunderland	,, 30	3,299	+ 210	13	18,378	+ 63	..	..
Swindon	,, 26	319	+ 4	..	..	..	4·4	..
Tyneside	,, 26	1,815	+ 45	24	11,620	+ 612	8·87	..
Wallasey	,, 29	1,772	+ 59	12⅝	10,690	+ 202	8·5	·05
Walthamstow	,, 29	1,411	+ 9	13	8,890	— 218	9	..
West Ham	,, 27	4,779	+ 51	13	30,844	+ 1,000	14·7	..
Wolverhampton	,, 26	1,657	+ 41	20	10,869	— 186	20	..
Yorks. W. Riding	,, 30	2,272	+ 619	26	28,851	..	..	..
Baker St.-Waterloo	,, 29	5,285	+2,458	26	38,505	+15,892	4	·75
Cen. London Rly.	,, 29	11,087	—1,036	26	153,224	—16,789	6	..
†Char. +, Eus. Hmp.	,, 29	2,715	..	..	..	..	8	..
City & S. Lon. Rly.	,, 30	6,875	+1,933	26	78,100	+ 5,466	7·3	1·25
Dublin-Lucan Rly.	,, 28	262	+ 5	26	2,747	— 8	7	..
G.N. and City Rly.	,, 29	2,542	+ 190	26	47,134	+ 413	3·5	..
G.N., P'dy. & Brmp.	,, 29	8,640	— 70	26	102,669	..	..	..
L'pool Overh'd Rly.	,, 30	3,055	+ 12	26	37,468	+ 478	6·4	3·9
Mersey Railway	,, 29	4,031	+ 658	26	48,254	+ 2,923	4·5	..
Metropolitan Rly.	,, 30	32,570	+ 612	26	397,291	—26,256	24·5	..
Met. District Rly.	,, 30	16,067	+ 30	26	205,556	— 8,868	24	..
Anglo-Argentine	July 1	81,706	+5,169	26	428,285	+42,629	43	..
‡Auckland	May	10,246	+ 457	20	53,380	+ 3	19·2	·56
‡Brisbane	June	12,500	+ 905	..	..	..	..	..
‡Brit. Columbia Rly.	May	26,123	+7,590	52	271,462	+56,121	..	..
Bu'n's A'r's E.T.Co.	Mar. 2	2,247	+ 220	9	14,647	+ 1,859	..	..
†Bu'n's A'r's-Blgr'no	Apr. 21	3,911	+ 314	16	60,228	+ 4,091	..	..
Calcutta	June 29	5,640	+ 6	..	..	..	..	..
§Cape Electric T. Ld.	May	12,710	..	..	..	..	..	..
‡Geneva	,,	8,399	+ 422	..	..	..	..	..
‡Kalgoorlie, W.A.	,,	3,287	..	21	19,545	..	20½	..
Madras	June 20	1,040	+ 188	26	18,598	+ 2,282	12·75	2·25
‡Lisbon	May	896	..	..	..	..	..	..
Perth (W.A.)	June 28	2,678	— 106	26	37,587	— 1,175	25·6	·4

* Compared with the corresponding period of 1906. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Class of Share.	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations June 25th.	Closing Quotations July 2nd.	Business done week ended July 2nd, 1907. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
35,000	Amazon Telegraph Co.'s shares, Nos. 1 to 35,000	10	Nil	Nil	Nil	..	8 — 8½	8 — 8½	..	..	..	Nil
149,600	Do. do. 5 % Debs., Nos. 1 to 1,256 Red.	100	Nil	Nil	5 %	5 %	88 — 91	86 — 89 xd	..	..	- 2	5 12 4
660,660	Anglo-American Telegraph	Stock	61s.	23/4 %	33/4 %	33/4 %	61 — 64	61 — 64	..	..	..	6 1 1
3,169,670	Do. do. do. 5 % Pref.	Stock	6 %	5¾ %	6 %	6 %	107½ — 108½	107⅜ — 108½	108½	107⅜	+ ⅛	5 10 7
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	1¾ %	1¾ %	19 — 19½	20 — 20¾	20⅛	19⅝	+1	8 12 10
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	..	99 —101	100 —103	..	..	+ ½	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	..	6¾ — 7¼	6¾ — 7¼	7⅛	..	..	5 10 4
2,097,680	Commercial Cable Sing. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	92 — 94	91 — 93 xd	92⅛	92⅜	—1	4 6 0
16,000	Cuba Telegraph	10	0	5 %	5 %	5 %	7⅞ — 8¼	7⅞ — 8¼	..	..	..	6 1 3
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	15½ — 16½	15½ — 16½	..	..	..	5 19 5
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅝ — 3¾	3⅝ — 3¾	..	..	..	5 6 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¾ — 9¼	8¾ — 9¼	..	..	..	5 8 1
20,000	Do. do. 4½ % Debs.	20	4½ %	4½ %	4½ %	4½ %	100 —103	98 —101 xd	..	..	—2	4 9 1
60,710	Direct United States Cable	20	8 %	8½ %	4½ %	..	15½ — 16¾	16⅛ — 15½	..	..	+ ⅜	5 4 7
57,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½ %	4½ %	4½ %	4½ %	100 —102	98 —100 xd	..	..	—2	4 10 0
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	135 —140	135 —140	138½	136½	..	5 0 0
2,000,000	Do. 5½ % Pref. Stock	100	5½ %	5½ %	5½ %	5½ %	89 — 91	89 — 91	91	89	..	3 16 11
1,996,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	104½ —106½	103½ —105½	..	..	—1	3 15 10
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅝ — 13⅛	13 — 13½	13½	12⅞	+ ⅜	5 3 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	104½ —106½	104 —106	..	..	— ½	3 15 6
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
181,127	Globe Telegraph and Trust	10	5¼ %	5¼ %	5¼ %	5¼ %	10⅞ — 11⅛	10½ — 11 xd	10⅝	10⅛	— ⅜	5 0 0
181,127	Do. do. 6 % Pref	10	6 %	6 %	6 %	6 %	13⅝ — 14½	13⅜ — 14 xd	13⅞	13⅜	— ⅛	4 5 9
150,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	24 %	24%	20 %	34 — 36	34 — 36	..	..	..	5 11 1
28,200	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100—102	98 —100 xd	..	..	—2	4 10 0
17,000	Indo-European Telegraph	25	10 %	18 %	18 %	13 %	56 - 58	56 — 58	..	..	..	5 12 1
$41,880,400	Mackay Companies Common	$100	..	1 %	2 %	3½%	68 — 70	66 — 68 xd	..	..	—2	5 2 11
$50,000,000	Do. do. 4% Cum. Pref.	$100	..	4 %	4 %	4 %	67 — 70	67 — 69 xd	..	..	— ½	5 15 11
466,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜ — ½	5/16 — 7/16	..	..	— 1/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	5 %	5 %	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	¾ — 1	¾ — 1	..	..	..	5 0 0
2,295,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108 —110	108 —110	108⅝	108½	..	5 9 1
2,295 000	Do. do. Def. Stock	100	5 %	5 %	5 %	5¾ %	104 —106	106 —108	107	104½	+2	5 1 10
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11½ — 12½	11½ — 12½	..	..	..	4 8 11
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅝ — 5⅞	5⅝ — 5⅞	5½	5⅛	+ ⅛	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	95¾ — 97¾	94 — 96 xd	97¼	96	—1½	3 14 11
1,986,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	99 —101	..	..	—1	3 19 8
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6¾%	6¾%	7 %	7 %	1½ — 1⅝	1⅝ — 1⅞	27/8	25/9	..	5 1 10
50,000	Do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1 1/16 — 1⅛	..	..	+ 1/16	4 11 5
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	4 %	4 %	95 — 98	13 — 16 xd	..	..	—2	4 3 4
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —101	97 —100 xd	..	..	—1	4 0 0
11,889	Reuter's	8	5 %	5 %	5 %	5 %	7½ — 8½ xd	7½ — 8½	..	..	..	4 14 1
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½%	4½%	99 —102	98 —101 xd	..	..	—1	4 9 1
8,167	Submarine Cables Trust	Cer	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
60,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6¾ — 7¼	6¾ — 7¼	..	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5 — 5⅜	5 — 5⅜	5⅜	..	..	4 10 11
15,609‡	West African Telegraph, Shares	10	4 %	4½%	4 %	4 %	10 — 10½ xd	10 — 10½	..	..	..	3 16 2
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2	Nil	Nil	Nil	2½%	1⅜ — 1⅝	1⅜ — 1⅝	25/-	21/6	..	Nil
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	97 —100 xd	..	..	—2	4 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13⅜ — 14½	13⅜ — 14⅛ xd	14⅛	13½	— ⅛	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —105	100 —103 xd	..	..	—2	3 17 8
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅞ — 1	⅞ — 1	..	..	— 1/16	Nil
84,668	Do. do. 6 % Cum. 1st Pref.	10	7 %*	6 %	6 %	8 %	7⅜ — 7⅝	7⅜ — 7⅝	7⅜	..	..	10 0 6
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6½ — 7½	6½ — 7½	..	..	..	Nil
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —104	100 —103 xd	..	..	—1	4 17 1

‡ Including arrears.

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

275,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007	5	..	8 %	8 %	8 %	8 — 8½	8 — 8½	8⅜	8 3/16	..	4 14 1
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5½%	5¾ — 6	5¾ — 6	5⅞	5 23/32	..	4 11 8
266,800	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	124 - 127	111 —114 xd	..	..	—3	4 9 7
235,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	102 —105 xd	..	..	—2	4 15 3
880,000	Babcock & Wilcox, 1 to 880,000	1	17 %	20 %	20 %	10 %	3⅜ — 3⅝	3¼ — 4	78/1½	75/-	— ⅛	5 5 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1⅛ — 1⅛	..	..	— 1/16	4 0 0
98,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	7 %	5 — 5½	5 — 5½	..	..	..	6 7 3
40,000	Do. do. 7 % Cum. Pref...	5	Nil	7 %	7 %	7 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	5 9 2
50,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	..	5¼ — 5⅝	5¼ — 5⅝	..	..	..	5 4 4
90,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	4 %	3½ — 4¼	3½ — 4¼	..	..	..	4 14 1
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	100 —103	100 —103	..	..	..	4 17 1
600,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	98 —101	98 —101	99⅜	99	..	5 8 11
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	6 %	120 —125	120 —125	12½	..	..	4 16 0
3 0,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	103½—103½	105 —109	..	..	+ 1	4 11 9
600,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	102 —106	103 —107	105½	104½	+ ¼	4 13 6
238,000	Do. 4½ % 1st Mort. Debs., 1 to 5,250 ..	40	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
420,000	Do. 4½ % Vancouver Power Debs., 1 to 2,920	100	4½%	4½%	4½%	4½%	103 —105	103 —105	..	..	..	4 5 9
158,201	British Electric Traction	10	6 %	6 %	3 %	Nil	2½ — 2¾	2⅜ — 3⅛	61/3	49/4½	..	Nil
161,187	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %	6⅜ — 7⅛	6¼ — 7⅜	7 1/16	6⅜	+ ⅛	8 2 9
1,448,558	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	103 —106	103 —105	104	103	..	4 14 4
1,10,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	4½%	78 — 81	78 — 81	..	..	..	6 11 1
100,000	British Insulated and Helsby Cables	5	5 %	8 %	8 %	10 %	6¼ — 6¾	6¼ — 6⅞	..	..	..	7 8 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5¾ — 6¼	5¾ — 6¼	..	..	..	4 16 0
800,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	102 —105	101 —104	..	..	—1	4 6 7
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	92 — 96	92 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1½	1 — 1½	..	..	..	Nil
1 016,868	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	63 — 67	55 — 60 xd	58½	..	..	6 13 4
70,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅞ — 1⅛	⅞ — 1⅛	..	..	..	Nil
60,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	£	Nil	Nil	24%	Nil	1¾ — 2	1¾ — 2	..	..	..	Nil
110,000	Do. Non-cum. 6 % Pref. ..	£	6 %	6 %	6 %	Nil	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	Nil
125,000‡	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	88 — 91	88 — 91	..	..	..	4 18 11
125,000‡	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	75 — 78	71 — 74 xd	..	..	—4	6 1 7
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	8 %	4 %	3 %	3 %	3 1/16 — 4 1/16	4 1/16 — 4 1/16	83/9	81/8	+ ⅛	3 9 7
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	4⅜ — 5⅜	4⅜ — 5⅜	£4/4½	£0/-	..	5 17 1
27,500	Do "B" do. 1 to 27,500	5	6 %	6 %	6 %	6 %	4½ — 5½	4½ — 5½	..	..	..	5 14 8
18,200	Do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	105 —115	106 —115 xd	110½	110	..	4 6 11
90,000	Do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	101 —104	100 —103 xd	100⅜	..	—1	4 17 1
137,610	Calcutta Trams., 1 to 137,610	5	6 %	8 %	8 %	8 %	7½ — 7⅞	7½ — 7⅞	7 1/16	7⅜	..	5 3 0
80,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	..	..	..	5 %	5¼ — 5⅝	5¼ — 5⅝ xd	..	..	— ⅛	4 8 11
940,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	104 —107	101 —105	103½	102	—2½	4 9 9
85,000	Callender's Cable Construction shares	£	12½%	12½%	15%	15 %	9¼ — 10¼	9¼ — 10½	9¾	..	..	6 13 4
40,000	Do. do. 5 % Cum. Pref.	£	5 %	5 %	5 %	..	5⅜ — 5⅝	5⅜ — 5⅝ xd	..	..	— ⅛	4 8 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106¾—108½	105½ —107½ xd	..	..	—1	4 8 9
491,223	Cape E. Trams., 1 to 491,223	1	10 %	6 %	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	8 %	1¼ — 1⅜	1 1/16 — 1 1/16	24/9	..	+ 1/16	6 1 11
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 —102	97 —102	..	..	..	4 8 3
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	73 — 74	73 — 73	72	..	+1	5 6 8
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	94	..	..	4 5 1
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	53 — 56	53 — 56	..	..	..	7 2 10
1 450,000	City and South London Railway	Stock	2¾%	2¾%	13%	2½%	45 — 47	44 — 46	47	45	—1	4 12 5
88,000	Crompton & Co., Nos. 1 to 88,000	£	2½%	2½%	2½%	..	1 3/8 — 2 1/16	1 3/8 — 2 1/16	..	..	..	3 14 0
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	6 %	5 %	96 — 99	93½ — 96½ xd	..	..	—2½	5 3 8

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated, all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations June 25th.	Closing Quotations July 2nd.	Business done week ended July 2nd, 1907.		Rise + or Fall —	Present Yield per cent
		†	1903.	1904.	1905.	1906.			Highest	Lowest.		£ s. d.
200,000	Dick, Kerr & Co., 1 to 200,000	1	..	10 %	10 %	..	1⅝ — 1¾	1⅝ — 1¾	..	..	..	6 8 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	..	1 — 1⅛	1 — 1⅛	..	..	..	4 16 0
294,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	102 —105	100 —103 xd	..	..	—2	4 7 5
60,060	Dublin United Trams. (1896), 1 to 60,000	10	5%	6 %	6 %	..	13½— 14½	13½— 14½	..	..	..	4 2 9
59,987	Do. 5% Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	13 — 14	13 — 14	..	..	..	4 9 3
99,261	Edison & Swan Utd., "A" shrs., £3 pd., 1 to 99,261	5	Nil	2½%	4½%	..	1 — 1⅛	1⅛ — 1⅜	..	..	+ ⅛	9 1 10
17,139	Do. "A" shares, 01—017,139 ..	5	Nil	2½%	4½%	..	2⅛— 2⅜	2⅛— 2⅜	52/6	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 — 87	83 — 86 xd	..	..	—2	4 14 2
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	89 — 92	89 — 92	..	..	..	5 8 8
112,100	Electric Construction 1 to 112,100	2	4 %	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
31,200	Do. do. 7 % Cum. Pref., 1 to 31,200	2	7 %	7 %	7 %	..	1½ — 1⅝	1½ — 1⅝	..	..	..	8 0 0
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	4 %	5 %	5 %	5 %	8¼ — 8½	8 — 8½	..	..	— ¼	5 17 8
300,000	Do. do. 4 % Mort. Deb. ..	Stock	4 %	4 %	4 %	4 %	92 — 95	92 — 95	..	..	..	5 14 3
75,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 75,000	10	3 %	4 %	4 %	4 %	2 — 2½	2 — 2¼	..	..	..	20 0 0
96,000	Greenwood & Batley 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½— 10⅞	10½— 10⅞	..	..	..	6 13 4
60,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	109 —108	102 —108	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	11½ — 12½	11½ — 12½	11½	..	..	6 0 0
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	..	..	..	8 17 3
150,000	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105 —107 xd	105½—107½	106¾	..	+ ½	4 3 9
50,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10%	5 %	10%	10 %	15 — 16	15 — 16	..	..	..	6 5 0
37,500	‡Liverpool Overhead Railway, Ord.	10	12½	12½	Nil	Nil	1⅞ — 1⅞	1⅞ — 1⅞	..	..	..	Nil
10,000	† Do. do. Pref. £10 paid ..	10	5 %	5 %	5 %	5 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	6 13 4
600,070	London United Trams (1901), 1 to 60,007	10	8 %	6 %	8 %	8 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	8 8 7
999,980	Do. do. 60,008 to 100,000	10	8 %	6 %	8 %	8 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	5 9 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000 ..	10	5 %	5 %	5 %	5 %	7⅞— 8⅛	7⅞— 8⅛xd	8	..	..	5 14 8
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	84 — 88	85 — 89 xd	85	..	+1	4 9 11
814,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
500,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅞— ⅞	⅞— ⅞	..	..	..	4 12 9
350,000	Do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	96 — 99	94 — 97 xd	94	..	—2	4 10 11
80,000	Peebles (B.) & Co. 6 % Cum. Pref., 80,001 to 80,000	6	..	6 %	6 %	6 %	3¾ — 4¼	3¾ — 4¼	..	..	..	7 1 2
215,500	Potteries E. Trc.	1	5 %	5 %	4 %	4 %	⅞— ⅞	⅞— ⅞	7/6	..	..	6 8 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅞— ⅞	⅞— ⅞	11/-	10/6	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,850	Telegraph Construction and Maintenance ..	12	30 %	15 %	15 %	15 %	30 — 32½	31½ — 32½	32	31½	+ ½	5 11 1
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	101 —104	99 —102 xd	..	..	—2	3 18 5
599,900	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts. ..	..	..	5 %	5 %	5 %	61 — 64	61 — 64	..	..	..	7 16 3
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	2 %	Nil	Nil	..	1¼— 1⅝	1¼— 1⅝	..	..	..	Nil
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3½ — 4	3½ — 3¾	77/6	..	— ¼	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	77 — 81	77 — 81	..	..	..	

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5½%	5½%	5½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 4 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 30,000	5	10 %	10 %	10 %	10%	7⅞ — 8⅜	7⅞ — 8⅜	..	..	..	6 1 3
10,202	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 2 4
336,976	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	8 %	8 %	5 %	5 %	3 — 4	3 — 4	70/-	65/-	..	6 5 0
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4½	4 — 4½	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Pri.	5	4½%	4½%	4½%	4½%	3¾ — 4¼	3¾ — 4¼xd	..	..	— ¼	5 9 1
427,400	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97 xd	..	..	..	4 2 6
49,486	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3¼— 4¼	3¼— 4¼	..	..	..	4 14 9
175,000‡	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	103 —106	101 —104 xd	103½	..	—2	4 6 7
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	9 — 10	9 — 10	..	..	..	6 0 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¼ — 12¼	11¼ — 12¼	..	..	..	4 18 0
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	123 —126	120⅝ —123⅝xd	..	..	—2½	4 1 0
900,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	97 —100	95 — 98 xd	..	..	—2	4 11 10
40,000	County of Durham Electrical Power, Ord.	5	4 %	£5 7 0	4 %	4 %	4⅛— 5	4⅛— 5	..	..	..	4 0 0
60,000	Do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	4⅛— 5	4⅛— 5	..	..	..	5 0 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	7⅞— 8⅛	7⅞— 8⅛	..	..	..	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜— 11⅛	10⅜— 11⅛	..	..	..	5 4 4
400,000‡	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	104 —107 xd	..	..	—2	4 4 1
400,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	93 — 96	93 — 96	9⅛	..	..	4 13 9
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	4 %	..	½— 1	½— 1	17/6	..	..	11 0 0
80,000	Do. do. 6 % Cum. Pref... ..	5	6 %	6 %	6 %	..	1⅜— 2⅛	1⅜— 2⅛	40/-	36/-	..	12 0 0
350,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	78 — 83	78 — 83	..	..	..	5 0 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅞ — 5⅜	4⅞ — 5⅜x d	..	..	..	5 8 5
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 15 8
90,000	Do. 4½ % 1st. Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
13,000	Hove, 1 to 13,000	5	8½%	8½%	9 %	9 %	7 — 7½	6⅞ — 7⅛	..	..	— ¼	6 4 2
21,000	Kensington and Knightsbridge Electric Ord. ..	5	13%	12 %	10 %	10 %	8¾ — 9⅛	8¾ — 9⅛	..	..	..	5 0 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	5 6 8
70,000	Do. do. do. 6 % Pref...	5	6 %	6 %	6 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 17 1
674,396	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	93 — 96	93 — 96	..	..	..	4 18 9
300,000	Metropolitan Electric Supply, 1 to 100,000	5	8½%	10 %	10 %	8 %	5⅞ — 6⅛	5⅞ — 6⅛	6⅛	..	..	5 14 3
75,121	Do. 4½ % Cum. Pref. 1—71,106 ..	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛— 4⅜xd	..	..	— ⅛	4 5 9
350,000‡	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —109	103 —107 xd	..	..	—2	4 4 1
350,000‡	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½%	3½%	3½%	3½%	88 — 93	86 — 91 xd	..	..	—2	3 16 11
350,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	93 — 96 xd	..	..	—2	4 13 9
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	7½ — 7⅞	7½ — 7⅞	..	..	..	5 3 3
75,000	Do. 5 % Pref., 1 to 75,000	5	5%	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	4 3 4
10,869	Notting Hill Electric Lighting	10	6 %	7 %	7½%	7½%	12 — 13	12 — 13	..	..	..	5 15 5
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6½%	7 %	7 %	7 %	6 — 6½	6 — 6½	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
46,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	13½%	10 %	7⅞ — 8⅛	8 — 9	8½	8⅜	+ ⅛	5 11 1
90,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6½ — 7⅛	6½ — 7⅛	..	..	..	4 13 4
1 20,000‡	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	3½%	88 — 93	86 — 91 xd	..	..	—2	3 16 11
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	Nil
80,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	73 — 77	73 — 77	..	..	..	5 3 11
65,000	South London Electricity Supply, Ord.	5	8 %	4 %	4 %	3 %	2 — 2⅜	1⅞ — 2⅛	..	..	— ⅛	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord...	1	Nil	Nil	2½%	2½%	⅜— ⅝	⅜— ⅝	..	..	..	3 6 8
117,968	Do. Do. 7 % Pref... ..	1	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 1 10
200,000	Do. Do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	11 2 0
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	2½ — 3⅛	3 — 3	..	..	— ⅛	8 6 8
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	4½%	4½%	4½%	94 — 97	94 — 97	95½	..	..	4 12 9
110,000	Westminster Electric Supply, Ord.	5	13½%	14 %	12 %	12 %	9 — 10	9 — 10	..	..	..	6 0 0
81,979	Do. do. 4½ % Cum. Pref. ..	5	5 %	5 %	5 %	4½%	5⅛ — 5⅜	5⅛ — 5⅜xd	..	..	— ⅛	4 0 0

(Original 5%— Red. to 4½ % from 31st Dec., 1905.

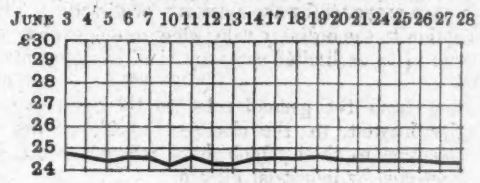
Unless otherwise stated all shares are fully paid. Interim dividends.

Bank rate of discount 4 per cent. April 25th. 1907

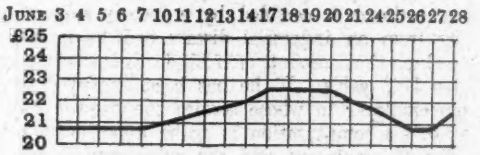
METAL MARKET.

Fluctuations in June, 1907.

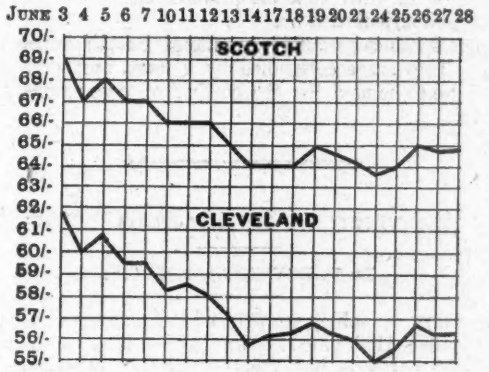
SPELTER (G.O.B's.).



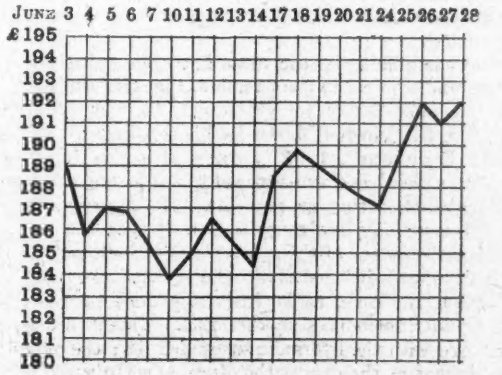
LEAD (ENGLISH).



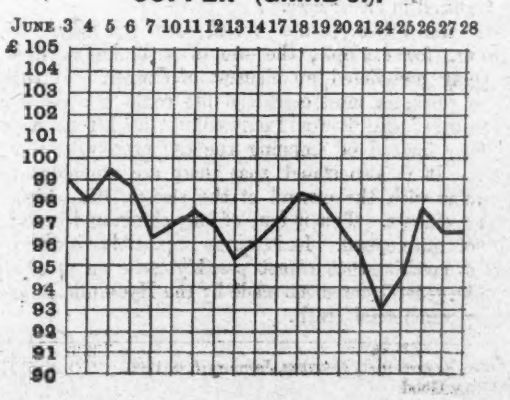
IRON.



TIN.



COPPER (G.M.B's.).



THE WORKMEN'S COMPENSATION RULES, 1907.

[FROM OUR LEGAL CONTRIBUTOR.]

The Workmen's Compensation Act, 1906, which so materially alters that branch of the law which provides for compensation to injured workmen, came into force on July 1st. The passing of the Act rendered it necessary to modify the rules which governed the procedure under the old Act. A new batch of rules was published by the Rule Committee on June 1st, and came into force on July 1st. As many of these throw light upon the practical working of the Act, it is necessary for all who are affected by the new measure to have some acquaintance with them. It is proposed, therefore, to touch upon such of the rules as appear to be of general interest and to deal somewhat more fully with those which nearly affect masters and men who are engaged in electrical work.

It is made clear by the rules that there need be no litigation if employer and employed come to an amicable arrangement. Thus it is provided by R. 8 (1) that

> An application for the settlement of any matter by arbitration shall not be made unless and until some question has arisen between the parties, and such question has not been settled by agreement.

If the parties fail to come to an arrangement, the applicant must file with the registrar of the local County Court what is called a request for arbitration. This request must have particulars annexed to it containing—

> (*a*) A concise statement of the circumstances under which the application is made, and the relief or order which the applicant claims.
>
> (*b*) The date of service of notice of the accident on the employer, or, if such notice has not been served, the reason for such omission and
>
> (*c*) The full names and addresses of the applicant, and of his solicitor, if the proceedings are commenced through a solicitor.

An employer who desires that there shall be an arbitration must file a request containing :—

> (*a*) A concise statement of the circumstances under which the application is made;
>
> (*b*) A statement whether the applicant admits his liability to pay compensation, or denies such liability, wholly or partially, with (in the latter case) a statement of the grounds on and extent to which he denies liability;
>
> (*c*) A statement of the matters which the applicant desires to have settled by arbitration; and
>
> (*d*) The full names and addresses of the respondents and of the applicant, and of his solicitor, if the proceedings are commenced through a solicitor.

It should be mentioned that, although the rules speak of arbitration, cases are in practice heard before the County Court Judge or his deputy. The day for the hearing of a dispute must be so fixed as to allow the copies of the request and particulars to be served on the respondents at least twenty clear days before the day so fixed.

Where a claim has been made against an employer he may adopt one of two courses. Thus by R. 17 :—

> If any respondent desires to disclaim any interest in the subject-matter of an arbitration, or considers that the applicant's particulars are in any respect inaccurate or incomplete, or intends to rely on the fact that he had no notice of the accident, &c., or that the claim for compensation was not made within the proper time: or intends to deny his liability *in toto*, he must file an answer with the registrar stating that he disclaims any interest in the subject-matter of the arbitration, or stating in what respect the applicant's particulars are inaccurate or incomplete, or stating concisely any fact or document which he desires to bring to the notice of the judge, or on which he intends to rely, or the ground on, and extent, to which he denies liability.

But he may get rid of the matter in another way. He may either give the registrar notice that he submits to an award for the payment of a weekly sum to be specified in the notice; or, where the application is made on behalf of the dependants of a deceased workman, or for the settlement of the sum payable in respect of medical attendance on, and the burial of, a deceased workman who leaves no dependants, pay into court such sum of money as the respondent considers sufficient to cover his liability in the circumstances of the case. Where money has been so paid in, and the representatives of the workman are content with and accept it, the employer may have to pay in addition any

reasonable costs incurred by them prior to the payment into court; but if the sum is not accepted within a reasonable time before trial, the employer becomes entitled to any costs which have been reasonably incurred by him since the date of payment into court.

With regard to indemnities by sub-contractors, the Act of 1906 provides by Sec. 4 that where any person in the course of, or for the purposes of his trade, &c., employs a contractor for the execution of the whole or any part of any work undertaken by the principal, the principal shall be liable to pay workmen employed by the contractor as if those workmen had been immediately employed by him. The same section provides (by sub-Sec. (2)) that where the principal is liable to pay compensation under this section, he shall be entitled to be indemnified by any person who would have been liable to pay compensation to the workman independently of this section, and all questions as to the right to an amount of any such indemnity shall, in default of agreement, be settled by arbitration.

Rr. 19—23 make the necessary provision for this ascertainment of liability. They provide that a person claiming an indemnity must file a notice of claim at the County Court in a certain form with the Registrar of the County Court within 10 days at least of the day fixed for the arbitration. The Registrar serves a copy of the notice on the person from whom the indemnity is claimed, and if he desires to dispute the applicant's claim as against the party on whose behalf it has been given or his own liability to such respondent, he must appear at the trial. In default of his doing so, he is deemed to admit the validity of an award made against the respondent, and his own liability to indemnity.

An illustration may serve to show the meaning of this rule. Suppose a builder employs a wiring contractor to do certain work. One of the wiremen is injured and becomes entitled to compensation. Upon his making a claim against the builder, the builder might be entitled to have an indemnity from the wiring contractor. It may be mentioned, however, that Sec. 4 only applies to cases in which the employer is carrying on a trade or business, so that neither the liability nor the right to indemnity would have to be considered in the case of a private householder. Local and public authorities are, however, to be treated as carrying on a trade or business within the meaning of the Act.

The Act also makes provision for indemnity where the injury has been occasioned to the workman by the tortious act of a stranger. In such a case his right of action against the wrongdoer and his right to compensation against the employer are both preserved. Under the Act of 1897 he had merely an option to proceed against the one or the other but not against both. Under the Act of 1906 (Sec. 6) he may take proceedings against both concurrently, but shall not be entitled to recover both damages and compensation. To take an instance—a workman employed by a firm of contractors in laying down an electric tramway is injured by the negligence of someone driving in the street. In such a case he may pursue his remedy against the employer, but the employer may bring the party who is really liable into the case. Rule 24 provides as follows :—

(1) Where a respondent claims that if compensation is recovered against him he will be entitled . . . to indemnity against any person not a party to the arbitration, he shall file and serve a notice of his claim in accordance with Rule 19 (*i.e.*, the rule relating to sub-contractors, *supra*).

The rule goes on to provide that if any person so served desires to dispute the applicant's claim as against the employer on whose behalf the notice was given he must appear and take part in the proceedings, otherwise he may find that an award has been made in his absence. The judge cannot, however, except by consent, decide the question whether the employer is entitled to be indemnified. Where, however, the arbitration results in an award in favour of the applicant, and the third party admits his liability to indemnity, the court may make an award against the third party. Execution cannot, however, issue on the award, until the employer has satisfied the award against him.

It is apprehended that an insurance company cannot be brought into the case under this provision. Indeed, so far as can be ascertained there is no provision in the rules relating to insurance companies with the exception of that which renders it possible for an insurance company to be substituted where a claim is made against a bankrupt employer.

Parties may appear in arbitrations either in person, by solicitor, or by counsel. By leave of the judge a workman may appear by a member of his family, or a person in his employment, while in the case of a company or corporation, it may be represented by the secretary or director. This is an exception to the ordinary rule, which provides that in all legal proceedings a limited company shall be represented by counsel.

Passing from the general rules to those which are of particular interest to the electrical world, we desire to draw attention to those which have relation to claims by persons affected by industrial disease.

Inasmuch as lead poisoning is one of the diseases scheduled to the Act, these rules are of particular interest to makers of accumulators. It is provided by Sec. 8 of the Act that where a workman is certified by a factory surgeon to be suffering from an industrial disease, or if he is suspended from work on that account, or if his death is so caused, compensation is payable. If he has been employed by more than one employer in whose service the disease may have developed, the compensation is to be apportioned between the different employers, and the rules provide that where one compensation is sought from one employer, he may take steps to have all the others who may be liable brought before the Court, in order that all questions outstanding may be settled and adjudicated on.

Space does not permit of our enlarging further upon these rules. They are accompanied by a large number of forms which are to be used for the conduct of proceedings under the Act.

ELECTRIC v. HYDRAULIC LIFTS.

By PERCY GOOD, A.M.I.C.E.

A certain pamphlet, recently revised and republished by the London Hydraulic Power Co., purports to show that hydraulic power is best for lifts, whether considered from the point of view of safety, convenience or economy. As it also contains a criticism of an article * which appeared in these columns and is intended for possible users of power, the mis-statements which it contains will be dealt with in some detail.

Safety is admittedly the most important of these three points, and we read in the pamphlet that the ram lift is the safest possible device for elevating. It is worth noticing that Mr. G. Croydon Marks in his text-book ("Hydraulic Power Engineering, 1905") states that the most serious accident which has ever happened to any public lift occurred upon a direct-acting or ram lift. He also remarks that, taking everything into consideration, the car of a suspended lift is probably one of the safest places to be found.

It is stated by the Hydraulic Power Co. that overbalancing the cage, as is frequently done in the case of electric lifts, introduces another risk. This is not so when compared with the hydraulic suspended lift; the only difference is that in the case of the electric overbalanced cage the smash might take place at the top, whereas with the hydraulic it could only do so at the bottom. Safety devices can be fitted in either case.

All the other points raised are somewhat trivial, such as, for example, the use of a brake to stop the car being considered an element of danger. If this did fail to work, in most cases the lift could not be started, and in other cases it would only allow the lift to over-run the floor instead of stopping the car exactly at the floor level. It is also stated that there are numerous points connected with the control of the electric lift which may cause accidents. This is true of any thing, and is certainly true of lift control. It is quite impossible to devise any form of machine that cannot possibly cause an accident, so that the general statement made by the Hydraulic Power Co. is only commercial truth.

* See Electrical Review, January 5th, 1906. "Electric Lifts," by Percy Good

Taking everything into consideration, there is in reality nothing to choose between the two forms of lift-driving from the point of view of safety, provided that in all cases the lifts are well made by competent firms.

The question of convenience is not of such importance, and the user can be depended on to decide this for himself. In the case of the electric lift, various means of control offer themselves, and the automatic appliances for preventing accidents, such as door catches, &c., are more easily and more cheaply fitted than with hydraulic power. The use of electricity to keep the water in the hydraulic ram from freezing is not unknown, and suggests possibilities of trouble which cannot occur in the case of an electric lift.

The question of economy is dealt with by the London Hydraulic Power Co. somewhat fully, and when it is seen

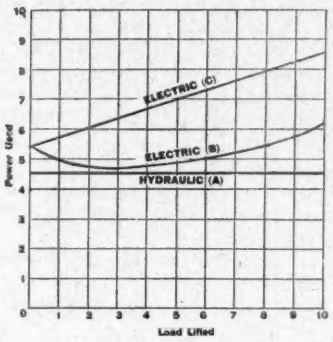


Fig. 1.

to what straits they are put to make any sort of case for the hydraulic lift, the reason for the rapid advance in the use of electricity will be apparent.

The curve shown in fig. 1 is taken from the pamphlet and attention is drawn to in order to prove that the hydraulic is cheaper than the electric system of driving; it is stated that this figure is taken from the *Proceedings* of the Institution of Civil Engineers, Vol. 130.

Fig. 2 shows the curves found in the volume mentioned, and it will be seen that the scales had been omitted, so that it was not possible to make comparisons of costs; without these scales the curves would never have appeared in the *Proceedings* of an Engineering Institution. It is true that

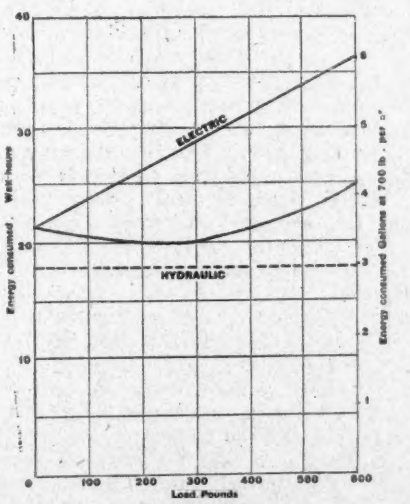


Fig. 2.

the theoretical equivalents are somewhat as shown, but one might as well suggest the use of silver instead of copper as an electrical conductor, because it has a lower resistance.

The curves shown in fig. 3 are plotted to one scale, and show the relative costs of hydraulic and electric power when 1,000 gallons of water costs 2s. and one B. of T. unit costs 1d. Such a low price for water could only be obtained by a user of several lifts, but the price for electricity is now the usual one, even for small consumers of power.

It would have been quite fair to publish either figs. 2 or 3 quoting the *Proceedings* of the Institution of Civil Engineers, but it is highly improper and unfair to do so with fig. 1.

The Hydraulic Power Co. never tire of informing the public that electric lifts take energy when travelling in either direction, and at the same time they (the company) double the results of tests published in this paper, and quote the writer as the authority for these figures.

Table I shows the results exactly as previously published. Tables II and III are the versions of these figures given in their pamphlet. In every case they are double those given in Table I. To calculate the consumption of energy from the original figures, the time of a complete journey must be taken; then the product of this, the average current and the average pressure will give the figure required.

The Hydraulic Power Co. have doubled the current and omitted to mention this important fact.

From the figures published in the pamphlet, and quoted therein, anyone making calculations of relative working costs in the two cases would naturally, by using these incorrect figures, obtain a power consumption of double the real figure. This result would then be accepted, because the figures are said to be taken from an electrical paper. It is a certain fact that the cost of running an electric lift is always less than for an hydraulic lift, both taking a supply from a power company.

It was shown that for offices with only one lift the cost of hydraulic power would be £8, and for electrical energy £3

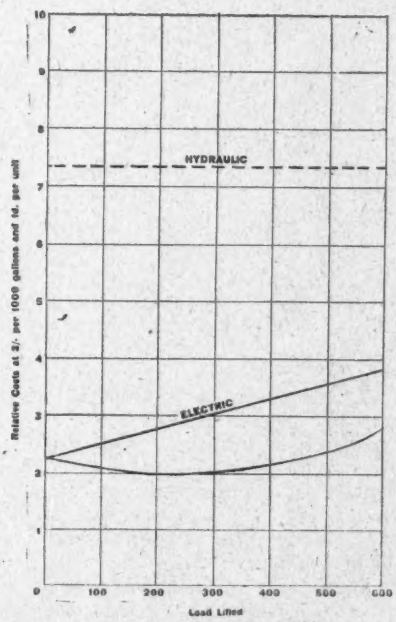


Fig. 3.

under exactly the same conditions, this when taking electricity at 2½d. per Board of Trade unit. But when 1d. is made the basis of calculation the relative costs are £8 and £1 4s. respectively.

Table I.

Load in cwts.	Average current at 543 volts.		Journeys for 1d. at 2½d. per B. of T. unit.	
	Up.	Down.	Up.	Down.
0	3·4	8·9	20	7
2½	3·7	7·1	19	10
5	4·4	5·3	16	13
7½	5·9	3·4	11	21
10	8·2	2·9	8	26

In the case of a consumer having several lifts, so that the charges for water power are reduced to 2s. per 1,000 gallons the ratio comes out at £4 to £1 4s. Under the most favourable circumstances for hydraulic power, taking into due consideration the stoppages and the variations in the load

up and down, the Hydralic Power Co. charge three times as much as an electric supply company for the same service.

In support of these figures, the following opinion, also published in the *Proceedings* of the Institution of Civil Engineers, Vol. 130, is given. Although the curve was selected by the London Hydraulic Power Co., they did not include this for publication as well.

Table II.
(Hydraulic Co.'s version of Table I.)

Load in cwts.	Average current in amperes at 540 volts used up and down.
0	12·3
2½	10·8
5	9·7
7½	9 3
10	11 1

Table III.
(Hydraulic Co.'s version of Table I.)

Load in cwts.	Average current in amperes used with varying load taken up and descending empty.
0	12·3
2½	12·6
5	13 3
7½	14·8
10	17·1

"The experience of the General Post Office showed that the relative costs of working electric and hydraulic lifts are as 1 : 5" (Sir William Preece). That is to say that the hydraulic lifts cost more than five times as much to run as the electric lifts. They generated their own electricity, but it would not have cost them less than 1d. per B. of T. unit.

We now come to the only points which may be in favour of the hydraulic lift; the first cost, the cost of maintenance and the life of the machinery. The first cost of the electric lift is usually higher than in the case of the hydraulic lift, but when comparing the two it is important to notice the methods of control, as it frequently happens that the comparison is made between a full automatic electric lift and a simple rope-starting hydraulic lift. If push-button automatic control were adopted for the hydraulic lift, it would add a large amount to the cost.

When comparing the cost of maintenance, it is also necessary to carefully discriminate between maintenance of the lift mechanism proper and the control. The hydraulic engineer compares maintenance of a simple hydraulic lift which requires an attendant with the maintenance of an automatic electric lift which does not require an attendant.

As an attendant would cost £50 to £100 per annum, it will be seen that there is a large margin for repairs. The actual cost of maintenance of the simple electric lift may be slightly greater than in the case of the hydraulic, but not sufficient to equalise the great saving in running costs. It is not necessary to show this by figures, as the Hydraulic Power Co. would have done (if it had been possible), instead of trying to show, by the peculiar methods described above, that the actual running costs were less in the case of the hydraulic lift.

Further, Mr. Unwin states (*Proceedings*, Inst. Civil Eng., Vol. 130) that the ——— Co. (an eminent firm of lift makers) were compelled to place the best before their employers (the customer), and if they were tied down to a low cost of maintenance they would advise electric instead of hydraulic lifts.

It will be noticed that all quotations have been taken from the same source as the London Hydraulic Power Co. relied upon for their argument.

The only conclusion that can be reached after careful consideration is that the electric lift is as safe as the hydraulic, much cheaper to use, and much less likely to cause discomfort in a house.

Accrington.—The annual report of the Corporation electricity department shows a surplus of 7s. 3d., whereas a loss of at least £450 was anticipated. A considerable balance on the right side is now anticipated for the current year. Reference is made to the large power demand and the steady reduction in the average price for light and power. The report says:—"In view of the great strides made during the last year it seems probable that the department will be self-supporting after the close of the current year." The number of consumers has increased from 331 to 363. The motors in use number 207 compared with 55 last year.

THE ENGINEERING CONFERENCE.

Continued from Vol. 60, page 1035.

Comparative Cost of Pumping by Steam, Internal-Combustion Engines and Electricity, Based upon Actual Working.

By Charles Hawksley and Henry Davey (Section VI.—Waterworks, Sewerage and Gasworks. Wednesday, June 19th).

We have already briefly commented on this paper. The authors take the case of continuous pumping for public water supply, drainage of land, &c., and compare direct-coupled steam engines and pumps, having a mechanical efficiency of 83 per cent., with electrical plant consisting of steam engine and dynamo (85 per cent.), cables (95 per cent.), motor (80 per cent.), gearing and pumps (75 per cent.), having a "total mechanical efficiency per P.H.P." of 48·45 per cent. Obviously the net mechanical efficiency is meant, but why "per P.H.P."? Both here and in other parts of the paper the authors' terminology is inexact, and the efficiencies given are not only unduly low, but are not all comparable, for the electrical plant includes cable which would enable the pumps to be a mile away from the dynamo. What would be the efficiency of a mechanical transmission of equal length? Needless to say, the relative fuel economy results as 10 to 17 in favour of steam. Generally speaking, it is stated, in an ordinary steam pumping establishment, the cost of fuel is "less than one-quarter of the cost of electricity at ½d. per unit," and the conclusion is deduced "that electric-pumping plant cannot be economical in fuel, as compared with steam-pumping engines of moderate economy." The possibilities of gas engines are considered briefly, but no definite conclusions are put forward; and oil engines are dismissed as unknown to the authors in this connection.

Discussion.

Mr. Hawksley said that the paper was only intended to start a discussion, and what was now wanted was the facts which others had in their possession. The great difficulty was in making the facts to be considered in dealing with the various installations compare with each other, as so much depended on situation, proximity to coalfields, amount of work to be done, and the supervision required, &c. No doubt the improvements being made in gas and oil engines would result in economies being effected in working, but he thought that the use of electricity would depend more upon the convenience with which it could be applied for certain kinds of work, than motives of economy.

Mr. Noble Anderson gave several instances relating to his experiences in pumping work in Australia and New Zealand. The results obtained were a duty of 150 million ft.-lb. per 1,000 lb. of steam. He had also erected several electrically-driven pumps, but when, later, he had to design pumps for Dunedin, New Zealand, he adopted a centrifugal pump, driven by a Diesel engine. The results were better than any he had obtained before, the combined efficiency being equivalent to 190 millions per 1,000 lb. of steam. The engines were guaranteed to give 1 B.H.P.-hour for a consumption of 0·4 lb. of oil; they were tested for a month, and in the result were slightly better than the guarantee. On this basis the thermal efficiency of the Diesel engine is 40 per cent., instead of the value given in the authors' paper. He considered that the results from electricity were better than the authors stated.

Mr. Baldwin Latham said that he would not dream of putting in large pumping systems except with triple-expansion engines.

Mr. Charles P. Sparks disagreed with the authors' comparison between steam and electrical pumping, and claimed that in new pumping installations for mine purposes electricity was superseding steam, whether fuel was cheap or dear. He had several pumps running between the limits of 250 and 450 H.P., and two had lately been constructed, driven by motors of 950 H.P. He pointed out that the comparison on page 2 of the paper was made with a boiler fixed close to the engine, driving a pump direct with an over-all efficiency of 83 per cent., and that if the pump were fixed below ground, the over-all efficiency would be far less than that figure, owing to the loss in the gearing. On the other hand, if the steam were on the surface and a direct-geared steam pump were fitted below ground, there were heavy losses occasioned by the length of steam pipe between engine and boiler, and the figure of 83 per cent. should be lowered accordingly. His experience of electrical efficiencies was 55 to 60 per cent., and not 48 per cent., as set out in the paper, and in naming this figure he included all transmission losses. The efficiency of the engine and dynamo he agreed with as approximately correct. The fact that the cable efficiency was taken at 95 per cent. would seem to indicate that the distance between the power house and the pump was very great. In ordinary practice the loss would only be 1 or 2 per cent. The efficiency

of large motors, however, in place of 80, would be over 90 per cent. That of the gearing and pumps would depend on the type of pump. With centrifugals, depending upon the head and quantity pumped, he put it at between 68 and 72 per cent., with three-throw geared pumps 75 per cent. (the figures stated by the authors), and with express high-speed pumps driven direct by motor 88 to 90 per cent. Generally speaking, he considered that while steam pumps would continue to be used for long hours of pumping, where boilers, engine and pump could be fixed close together at the surface, pumping of an intermittent character or below the surface would in future be electric. As to the references in the paper to cost of power, he pointed out that the figures quoted included capital charges, and stated that, even for loads not continuous during the whole hours of the year, power could be obtained substantially below the price of ½d. per unit mentioned by the authors.

Mr. Dugald Clerk thought that the heat efficiency of the gas engine was put too low at 25 per cent. In the case of a 50-B.H.P. engine, 35 per cent. would be expected, and in many tests 38 per cent. had been obtained; 35 per cent. had been taken by the Standards Committee. Taking the combined efficiency of a single gas plant at 86 per cent, he put the combined efficiencies of engines and pumps at 29 to 30 per cent.

Dr. Hopkinson thought that the authors had taken too high a figure for coal consumption in the case of gas engines; it would have been more nearly correct at 1·25d. per B.H.P. than 1·75d. He also thought the 70 per cent., which Mr. Davey gave as the mechanical efficiency of the gearing and pumps, could be considerably improved upon in a large installation, as direct driving would prevent loss in gearing, with the result that an efficiency of 77 to 78 per cent. would result. He did not think, in comparing the cost of electric driving, that it was fair to allow for any loss in the mains from the power house.

Mr. Phipps had had experience with an electric plant, viz., a single-phase alternating-current motor, 10,000 gallons being raised per hour 300 ft. in one lift. The energy used worked out at 1·31 units per H.P.-hour, and as the price was 1¼d. per unit, the cost was 2·3d. per B.H.P.-hour. It would have been necessary to get energy at ·45d. to compare equally with steam costs.

Mr. Llewellyn Atkinson said his views had, in general, been expressed by Mr. Sparks and Dr. Hopkinson. In particular he did not agree with the figure which the authors took as the cost of energy. A private installation should provide electricity at 0·2d., or very little over that, and taking that figure and the efficiencies given by Mr. Sparks, this would bring the figure very near that given for steam. With regard to the purchase of energy from power companies, these would now make contracts, for a 24-hours' load, considerably under the ½d. quoted by the authors. Where the load was not continuous, and arrangements could be made for the work to be done at night, this, of course, would advantage the companies, who would certainly supply on terms of the favourable nature he had indicated.

Mr. H. A. Humphrey thought a striking feature of the paper was the low mechanical efficiency of pumps with intermediate gearing. The figure of 50 per cent. left much room for improvement. He had designed and built a pump differing entirely from the usual kind, in which the explosion took place immediately in contact with the water or other liquid being pumped, the scale of operations being compression, explosion, expansion beyond the original volume, complete scavenging, suction, and so coming back to compression again. This pump had no piston, no fly-wheel, no crankshaft and none of the moving parts pertaining to an ordinary pump. The pump had not been completed in time for experiments prior to that meeting, but even if not at first successful he was confident the problem was capable of solution, and that a pump would be constructed dispensing with intermediate gearing, and allowing the explosion to act directly on the liquid. This would raise the efficiency much higher than the percentage stated in the paper.

Mr. Duncanson said his experience, which had principally been concerned with pumping stations for water-supply works, very closely confirmed that of the authors, the cost of fuel being something like £7 per annum per B.H.P. They had, however, a three-cylinder engine, made some years ago, which gave a much higher duty. In this case, if the engine was working the whole of the 24 hours, the cost would be a little over £5 per annum per B.H.P.

Mr. Binney gave some figures of his experience of a gas plant consisting of three sets of 38 B.H.P. Each pump gave 16·4 B.H.P. Consumption of coal (anthracite) was 20 lb. per hour, or 1·22 lb. per B.H.P.-hour, or 0·68 per B.H.P., or £5 8s. per annum per B.H.P. These figures were for six months' working.

Mr. Gore estimated the cost of working with a 200-H.P. Diesel engine at £5 7s. 6d. per pump H.P.-year, the efficiency of centrifugal pumps being taken at 80 per cent. and the cost of oil at £5s. per ton.

The Action between Wheel and Rail.

(Section I.—Railways. Thursday, June 20th).—The first paper on this day was one by Mr. H. R. A. Mallock, on "The Action between Wheel and Rail." It was an excellent paper, in a way; *i.e.*, it dealt with a definite problem under certain assumptions, and dealt with it logically, and with all the rigidity of the mathematical tripos. The problem might almost be stated in the time-honoured form of the examination paper: If a cylinder of steel of radius r be pressed against a steel rail of the same quality, and of breadth b, with a force of n tons, and if the steel be only capable of sustaining a load of w tons to the sq. in. without passing its elastic limit, find the deformation of rail and cylinder, and the value of r, so that no permanent flattening may result. Mr. Mallock's solution is that at the surface of contact the common radius of curvature is equal to the diameter of the cylinder (*i.e.*, of the wheel), and that the width of the tread must vary as the square root of the radius. Also that if $b = 1$ in., r must not be less than $2\frac{1}{2}$ ft. He takes $n = 4$, though in the discussion he was informed that it is about double that in practice; and he infers that since the tread is generally less than an inch broad, and that the wheels are always less than 5 ft. in diameter, there is always permanent deformation of the rail (and of the wheel, though this he does not mention) where the wheel rests on it. Hence he calculates the wear of the rail in a particular case, and arrives at the alarming figure of 2·6 in. a year. This, without taking any account of the wear due to the driving wheels or to the slipping at curves, or even on the straight, which, as he points out, must needs occur, unless the diameters of both wheels on the same axle be identical. To this slipping, and the torsional vibration of the axle due to it, he attributes the corrugations, of which so much has been heard of late. The cure he suggests for the wear is that the rails should be rolled of a different cross-section, a cure manifestly inapplicable to existing railways without an entire reconstruction of the line. The trend of the discussion was to show that, while the point brought forward was important, nearly all the assumptions of the problem were incorrect. That is, so far as the discussion was relevant, but the mention of corrugation was sufficient to turn it largely into a debate on roaring rails.

Discussion.

Mr. F. E. Robertson said that railway engineers had, during the past few years, been falling over one another in the race to destroy their rails. It was well to be reminded that there was a limit to the safe load. Some pleaded that rails were not now so good as formerly, but from a dozen samples of old and new Indian rails, sent home for examination on account of the trouble with roaring rails, the differences between the individual rails of each sample were greater than those between the average of the samples. Practically there was no discoverable change. Eight tons would be nearer the mark in practice than Mr. Mallock's 4 tons as the load per wheel. He thought the author's explanation of corrugations was about the truth.

Mr. A. W. Szlumper said that the wear on the rails was nearly all at the curves; there was no excessive wear on the straight. The trouble was quite as much with wheels as with rails. As to permanent deformation, Mr. Mallock's calculation was invalidated by the fact that the breadth of the tread was always more than 1 in., so that it was needless to alter the design of the rail head. Moreover, the wear was small at first, afterwards rapid, which was the converse of Mr. Mallock's statement of the case.

Prof. Carus Wilson had made a number of experiments to ascertain the actual stresses between rail and wheel, and his results were very similar to those of the author. In these experiments a glass bar (!) was used to represent the rail. He thought the formula given in a note to the paper incorrect, in that it made the force proportional to $b^{\frac{1}{2}}$ instead of b, and that, therefore, the stresses would be greater than those calculated when b was very small. The tendency of heavy wheel loads was to make actual fracture of the rail, and this not, as might be expected, with the tension greatest at the lowest point but at the top; so that the rail cracked at the top as though under a force tending to tear it apart from the top downwards. [All which is credible enough if we regard the points of greatest stress as the points midway between the wheels.] Hence it was not safe to invert a corrugated rail; it was certain in that case to snap across.

Prof. B. Hopkinson pointed out that one important element—that of time—had been omitted. The time of contact of wheel and rail when the train was running at normal speed was of the order of 0·001 sec., and experiments showed that repeated strains of that duration could be endured, though greatly in excess of the elastic limit of the material. Was there any evidence that the wear was greater with slow than with fast trains?

Mr. R. H. Burnett thought that the wear might be reduced by further attention to the design of bogies and brake gear. The wheel base was generally far too short for the gauge of the rails.

Mr. W. H. Short read (until he was stopped) a paper, in which he contended that wear was due to the outer leading wheel, and was most pronounced on sharp curves. On being told that reading was out of order, he continued, with an occasional glance at his MS., to the effect that the wear on the rail might be diminished by super-elevation, but was independent of the speed. Coning of wheels had practically no effect at curves.

Prof. W. E. Dalby questioned whether the wheels long remained circular where many stoppages and frequent braking occurred. He found that locomotive wheels required to be trued from time to time. If the wheels were not round their hammering on the rails would tend to rapid wear.

DR. HARBORD said that the assumption in the paper that wheels and rails were of the same quality of steel was incorrect. The tires were always harder, 26 to 28 tons per sq. in., against 20 tons for rail steel. Harder rails were used in America, but not so hard as to produce greater wear on the tires. On the Continent, steel containing from ·3 to ·35 of silicon was extensively used for wheel tires with good results. Not that silicon was a hardener, but it made a sounder steel.

Mr. D. D. COATH made the novel suggestion that the flanges should be on the outside of the wheel. He offered to show a model, and to demonstrate the correctness of his view. He said that he had convinced some railway engineers that he was right, and that by this means he could round an 8-ft. curve with a car of 8-ft. wheel base, but they told him he was 70 years too late.

Mr. W. WILLOX suggested that ripples on wheels were the cause of corrugations in the rails. Waves on the rails were even more serious than ripples, and these might be of any length, from 9 in. to 6 ft. He rejected the idea that the nature of the sub-soil had anything to do with the question, or that it was a matter of the rigidity of the trucks.

Mr. E. BENEDICT remarked that in corrugated rails the ridges were bright, the hollows dark, and asked "Why?" Also whether the ridges travelled forward along the rail? The action of the driving-wheel on the rail was of the nature of a pinion on a rack; it gripped it by its inequalities, and tended to grind it down. The action of the rest of the wheels was, in comparison, negligible.

Mr. J. W. TWINBERROW argued that if that were so, the wear should be greater on steam lines than with electric traction, whereas the contrary was the case. He attributed the trouble to a blind following of tramway precedent, especially in respect of short bogies. There was nothing to keep the bogies square, and the one-sided drive tended to set up unequal torsional vibration. Brake blocks should be on both sides of the wheel, and preferably on the inner rim.

Mr. R. J. HOWLEY denied that the truck had anything to do with corrugation, nor yet had the driving wheels, for corrugations were found on cable-tram rails. They resembled sand ripples on the sea-shore, and he put them down to cold rolling. In roaring rails, analysis showed that the percentage of carbon to manganese was low. When the percentage was over 40 the trouble disappeared.

Mr. W. R. GALBRAITH (Chairman) said that the Waterloo and City line was laid very tight to gauge, hence the wear was excessive. The character of the rolling stock had a great effect in the matter. As the guides on that railway became worn, more side play was permitted, and the mischief was diminished.

Mr. MALLOCK, in his reply, said that he had but proposed to treat of one of the many causes of wear in rails; the specific relation between the limit of elastic strain and the deformation. He entirely endorsed Prof. Hopkinson's view that time should enter explicitly into the calculation. Torsional vibration was the only initial cause he could find for ripples.

(To be continued.)

PROCEEDINGS OF INSTITUTIONS.

Telephonic Transmission Measurements.

By B. S. COHEN, Associate Member, and G. M. SHEPHERD.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *May 9th*, 1907.)

IN order to apply in a practical manner the laws which govern the transmission of telephone waves, it is necessary to have fairly accurate quantitative information regarding the various factors concerned. The latest formulæ for calculating attenuation take into account practically all these factors, and have been proved to give solutions of most of the transmission problems met with in practice, but unfortunately very little is known as to the value of most of these factors.

The results described in this paper have been obtained in the investigation laboratory of the National Telephone Co., and embody methods of measuring frequency, distortion, attenuation, current and power of telephone waves, and also line and instrument impedances.

As might be expected, the oscillograph has afforded a great deal of useful information with regard to telephone waves.

The instrument used is the high-frequency pattern of Duddell. This instrument has two separate vibrators which can be used in a variety of ways. For investigating the attenuation and distortion of waves over telephone lines, one can be placed at the beginning, and the other at the end of the line.

Owing to the high frequency and general complexity of many of the telephone waves, it is very necessary that the vibrators should be working at their correct damping temperature in order to obtain reliable records; the best test for correct damping is a square wave produced by interrupting a direct current.

Fig. 1 shows a number of vowel sounds as interpreted by a common-battery solid-back transmitter working at normal load. These vowel sounds are quite characteristic, and can be picked out in many oscillograms of complete words, although they get altered somewhat in shape by different voices. The small ripple on the flat portion of the E wave marked y, for example, is considerably amplified in some voices, and the portion x very often disappears completely. The main characteristics, however, remain. E appears to be much the simplest of all the vowel sounds.

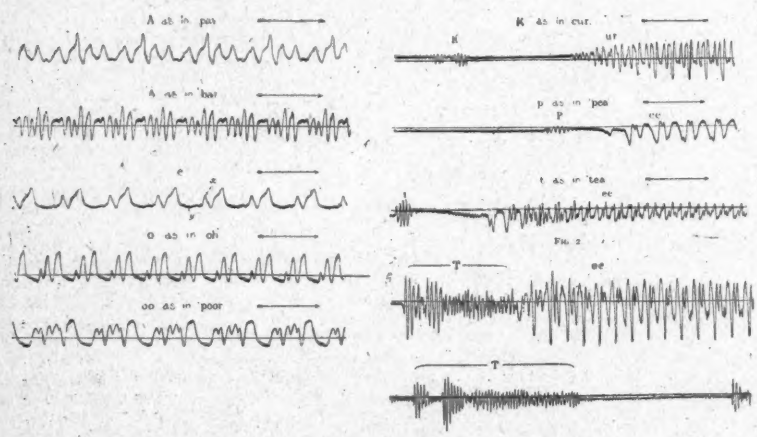
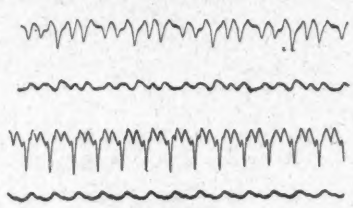


FIG. 1.

FIG. 3.



FIGS. 4 AND 5.

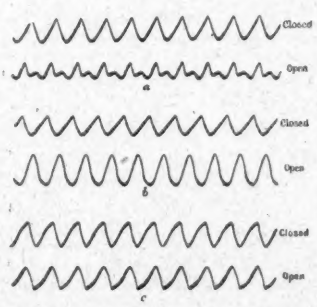


FIG. 6.

Fig. 2 shows a number of consonants and words. It will be seen that the explosive portion is quite separate and distinct from the vowel portion, being, in some cases, separated by an interval of quiescence. It was thought that this might be due to the transmitter diaphragm, which in the case of the solid back is somewhat heavy and is strongly damped, and would not therefore respond to the brief consonant portion so well as to the vowel portions. In order to prove this, the same consonants were recorded, using both the solid-back and a lighter diaphragm granular transmitter.

Fig. 3 shows the sound "tea" with the light diaphragm transmitter. In this case the consonant portion is nearly of the same amplitude as the vowel portion, the diaphragm is also very little damped and indicates high-frequency vibrations in the interval between the consonant and the vowel which were not shown up by the solid back. Fig. 3 also shows an oscillogram of the consonant portion of "tea" taken by itself. This is clearly a reproduction of part of the preceding figure and helps to prove the accuracy of these oscillograms. It is interesting to note that the tests of the particular light diaphragm-transmitter used gave articulation superior to that of the solid back, although the former transmitter was in some ways inferior to the latter.

The most efficient sound from the point of view of amplitude is the "oo" vowel sound as in poor, whilst the least efficient sounds are the consonants "s" and the rolled "r"; the "r" is of very high frequency.

The oscillograph is obviously specially suited to the investigation of the attenuation and distortion of waves over telephone lines, and particularly to the latter.

Fig. 4 shows the attenuation and distortion of a fairly complex sound wave (singing "la") over a 16-mile cable line. The cable in this case was equivalent to one with 17·6 miles of 20-lb. conductors, and the transmission over this length of line is very good indeed.

On analysing the received wave it is found that everything above the seventh harmonic seems to have been practically wiped out, and this harmonic represents a frequency of 980.

The analysis of the two waves in fig. 4 brings to light the fact that the attenuation of the current behaves in a curiously fluctuating

manner as the frequency increases. The following table gives percentages of received currents for the various harmonics:—

Harmonic.	Percentage received.	Harmonic.	Percentage received.	Harmonic.	Percentage received.
1 (Fundamental)	81·0	6	28·0	11	81·0
2	47·0	7	25·0	12	13·0
3	57·0	8	30·0	13	2·5
4	46·0	9	25·0	14	15·5
5	41·5	10	25·0	15	4·0

The big rise at the eleventh harmonic is very noticeable.

A further example of this effect is apparent in the wave-forms of fig. 5, which represent singing "oo" sound on 30 miles of cable.

The ninth harmonic is the notable one in this case, and would have a frequency of about 2,295. Such analyses as the above are, of course, somewhat rough affairs, owing to the difficulty in obtaining clearly defined enlargements of attenuated wave negatives; it is also an extremely laborious business.

The absence of precise data renders it impossible to explain the phenomena theoretically. That such an occurrence is in some degree possible, however, may be demonstrated by taking an arbitrary complex E.M.F., and supposing this to be impressed upon

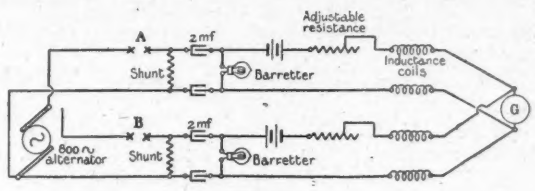


Fig. 7.

a circuit of known electrical constants. What precisely the practical effect on transmission is of this special reinforcement and diminution of certain tones we cannot at present say. The subject of line resonance seems, however, to be one worthy of closer investigation.

Highest Important Frequency.—If the spacing—*i.e.*, distance apart—of loading coils is increased, and at the same time the amount of inductance per mile inserted is unchanged, the attenuation constant also increases gradually, and at one particular spacing increases to an enormous extent.

A series of articulation observations were made on 20 miles of cable for increasing spacing intervals with a constant load of 0·17 henry per circuit mile and commencing with a distribution of 1 load per mile.

It was found that a 2-mile load was very slightly inferior to the unloaded line of equivalent speaking volume, but still gave excellent commercial transmission. This indicates that harmonics above 1,600 cycles per second may be dispensed with.

With 3-mile distribution the articulation was commercial, but decidedly inferior to the unloaded line. The critical frequency for this disposition of the load was about 1,100 ∼, and it is thus apparent that harmonics between 1,100 ∼ and 1,600 ∼ are valuable.

For 4-mile intervals speech became quite impossible, although the volume was still quite considerable, and we must therefore conclude that the highest indispensable frequency lies between 800 and 1,100 cycles, and also that it is desirable to retain something higher than 1,100 cycles for really high-grade transmission. Probably 1,500 cycles would be quite a satisfactory figure to base calculations on

Pupin and other writers use 750 to 800 cycles for many transmission calculations. It is important to note that this represents a fair average frequency, as damping constants calculated with this value can be obtained experimentally when using actual speech waves.

Opening and Closing Receiving End.—Fig. 6*a* shows the effect on the transmitted wave when opening and closing the receiving end of a line consisting of 2 miles of 20-lb. cable. With this short line the cable current passing from the A to the B wires, by virtue of their mutual capacity, is smaller than the total current flowing when the far end is closed. The variation in wave-form is also very noticeable. When, however, the line is 7·5 miles of the same cable, the current is actually greater when the far end is open than when it is closed (see Fig. 6*b*). Lastly, when the line gets beyond a certain length, the effect on the amplitude at the transmitting end by opening and closing the receiving end is negligible. Fig. 6*c* shows the effect with 20 miles of 20-lb. cable.

These phenomena are due to the action of the terminal impedance, and may prove of considerable importance to the telephone engineer, as they can be varied to a great extent by varying the impedances of the terminal apparatus. With long lines the tendency is for the impedance at the sending end to become a constant quantity, not varying appreciably with the length, and the reaction of the terminal apparatus becomes evident only to a very small degree at the sending end.

Current Measurers.—The *barretter*, otherwise termed the *bolometer*, is a device for measuring small alternating or fluctuating currents. It consists of a conducting wire or filament, which has a high temperature coefficient and a small mass, so that small currents will appreciably raise the temperature, and thus alter the resistance.

Dr. Hayes, of the American Telegraph and Telephone Co., found that small low-voltage telephone switchboard lamps gave satisfactory results, and this has been confirmed by experiments carried out by us. The best lamp we have found for this purpose is a special pattern 24-volt curl filament lamp for telephone switchboard use.

Null Method.—The following arrangement of barretters (fig. 7) has been adopted after considerable experiment; this arrangement enables measurements of apparatus and line impedance, capacity, &c., to be carried out, the result being obtained in actual ohm values and with very little more trouble than that involved in taking an ordinary resistance measurement with direct current.

The figure shows a source of alternating current such as a sine-wave alternator connected to two branch circuits, in one of which a variable resistance box A is inserted. The other arm has the apparatus or line to be measured, inserted at B. The barretters are connected through adjustable resistances and batteries to the galvanometer, which can be of any pattern.

The shunt, which for general work can be varied from 10 to about 500 ohms, helps to eliminate errors due to the impedance of the barretter circuits.

The barretters are first balanced in resistance by the adjustable resistances until the galvanometer indicates no deflection. The alternating current is then applied, the circuit being through the condensers and round the barretters. This current is stopped from passing from one branch into the other, *viâ* the galvanometer, by the four choking coils. When the resistance box in A is adjusted so that no deflection is indicated on the galvanometer, then the resistance unplugged in A, after making allowance for the impedance of the shunted barretter circuits, represents the impedance of B, and if the two barretters are not exactly similar, a second reading can be taken with A and B reversed and the mean taken. Variations in barretter resistance caused by temperature changes have no effect on this arrangement, as the barretters are fixed close together and compensate each other.

Deflectional Use.—In this method only one barretter is actually used, the other being merely left in the circuit to balance the one used, both for atmospheric temperature variations and for resistance. One of the barretters is inserted in the circuit in which the value of the current strength is required, and the change in its resistance due to this current causes the galvanometer to deflect. The instrument then becomes practically a hot wire ammeter; 60 micro-amps. correspond with 10 divs. deflection (about 5 mm.); this is about the minimum measurable.

Duddell's thermo-galvanometer has been used for current measurements. It has many advantages, and for deflectional methods is probably unrivalled if the source of power is absolutely steady, but it cannot be satisfactorily employed with transmitters in circuit owing to their variability, even although the sound impressed is quite steady.

(To be concluded.)

The Moore Vacuum-Tube Light.—The past few years have witnessed the commercial application of a new and distinct type of lamp, that is, the enclosed vapour or vacuum-tube lamp. Three forms have become generally known, and these are the Cooper-Hewitt and the Bastian type, both of which use mercury vapour as the conducting medium, and finally the Moore vacuum tube. Moore's experiments were commenced 12 years ago, with the object of producing a "cold light," *i.e.*, one in which the whole of the electrical energy is converted into light. At that time the maximum efficiency of the best arc lamp did not exceed 10 per cent., whereas now as high a value as 50 per cent. may be obtained. From this point of view, the practical value of the new lamp is not very great, as the light efficiency does not exceed 15 per cent. of the total current used, but it shows that the experiments have been conducted in the right direction. The lamp, as it is now being installed, consists of a 1¾-in. glass tube of any desired length, which is supported in a suitable bracket. The electrodes are of carbon, electrically connected with the exterior by platinum wires sealed in the end of the tube, which, in turn, are connected to a transformer raising the pressure of the alternating current supply to 10,000 volts. These tubes are evacuated until the air pressure inside is reduced to $\frac{1}{10000}$th of an atmosphere. The light obtained in this manner is a soft one, rose-red rays predominating. In working these tubes, it was found that the air pressure became considerably reduced after a time, and, as a consequence, the light began to fall off in brilliancy, and finally disappeared altogether. To overcome this trouble, a very simple regulator was introduced to admit automatically a small air supply from time to time. The Moore lamp is practically a lengthened Geissler tube. The advantages claimed by the inventor are the following:—High efficiency, good actinic value, low intrinsic brilliancy, safety, perfect illumination, free from shadows, and a very long life. The efficiency of the tube was subjected to careful photometric test by the New York Electrical Testing Laboratories, and the following results were obtained per candle-power efficiency:—Moore lamp required 0·65 watts, the Nernst 1·1 watts and the carbon filament 3·5. In addition to this, a white light may be produced, but the efficiency is not as good as the above. The tubes are difficult to repair, and leave a room entirely without lighting facilities for a long time in case of failure or accident to any part of the system. The high initial cost is also against a general adoption of such a system as this.—*Electrochemical and Metallurgical Industry*, Vol. V, No. 5.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

26,933A/06. "Improvements in vibratory controlling devices for induction coils and the like." P. M. Justice. (Orswell Igniter Co., United States.) (Date applied for under Rule 5 of the Patents Rules, 1905, November 27th, 1906.) June 22nd. (Complete.)

13,926. "Splicing sleeve or ear for jointing trolley wires, cables and the like." F. Jones. June 17th.

13,930. "Improvements in governors for the engines of petrol-electric cars." W. A. Stevens. June 17th.

13,932. "Automatic cut-out specially adapted for intense current." E. Pirdschun and A. Baruch. June 17th.

13,940. "Improvements in trolley-pole holders." G. R. Forster. June 17th. (Complete.)

13,943. "Improvements in or relating to the insulation of electric conductors and compounds therefor." W. A. Phillips and F. Hutchins. June 17th. (Complete.)

13,983. "Improvements in storage batteries." H. E. R. Little. June 17th. (Complete.)

13,986. "Improvements in the manufacture of metallic filaments for electric glow lamps." H. J. Haddan. (Bergmann-Elek.-Werke Akt.-Ges., Germany). June 17th. (Complete.)

14,037. "Safety circuit-breaking device for petrol-electric cars." P. H. Frost-Smith and W. A. Stevens. June 18th.

14,059. "Apparatus for the electric lighting and heating of vehicles." H. Grob. (Date applied for under Patents Act, 1901, July 6th, 1906, being date of application in Germany.) June 18th. (Complete.)

14,087. "Improvements in arc lamps for changing the luminous intensity in any given direction." M. Fortuny. (Date applied for under Patents Act, 1901, June 19th, 1906, being date of application in France.) June 18th. (Complete.)

14,099. "Improvements in electric resistances." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 18th.

14,100. "Improvements in protective devices for electric conductor systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 18th.

14,130. "Improvements in or relating to electric ignition apparatus for internal combustion engines." B. Brooks and F. H. Alston. June 19th.

14,150. "Improvements in or relating to electrical signalling apparatus." E. E. Moore and W. Powles. June 19th.

14,169. "Improvements in apparatus for igniting gas electrically." E. Plumstead and Newton & Lawrence, Ltd. June 19th.

14,203. "Improvements in and relating to dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 20th.

14,221. "Improvements in electric fuses for use in blasting and the like." W. A. Malson. June 20th. (Complete.)

14,238. "Improvements in telegraph sounders." British Insulated and Helsby Cables, Ltd., and W. Bartlett. June 20th. (Complete.)

14,255. "Improvements in and relating to secondary batteries." E. L. Oppermann. June 20th.

14,262. "Improvements in or relating to electric telegraph apparatus." S. G. Brown. June 20th.

14,269. "Improvements relating to trolley poles used upon electric tramways." C. J. Johnson and G. Toogood. June 20th.

14,285. "Improvements in electric hydrogen and oxygen generators." S. O. Cowper-Coles. June 20th.

14,286. "Improvements in alternating current generators and motors." O. Mietens, A. Kusnetzoff and R. Trechcinski. June 20th.

14,288. "Improvements in and relating to electric rheostats." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 20th.

14,289. "Improvements in and relating to the control of electric motors." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges., Germany.) June 20th.

14,347. "Device for automatically, by hand, or electrically releasing catches for protecting-mats for hot-houses, espaliers, and the like." E. L. Becker-Bertrand. June 21st.

14,360. "Improved mercurial electric contact maker." F. Cossor, T. W. Flory, and G. Davenport. June 21st.

14,365. "Improvements in dynamo-electric machines." P. J. S. Tiddeman. June 21st.

14,368. "Improvements relating to automatic telephone switches." H. W. Lake. (Charles M. Thompson Co., U.S.) June 21st. (Complete.)

14,372. "Improvements in the electrolytic winning of zinc from solutions of zinc sulphate." Siemens & Halske Act.-Ges. (Date applied for under Patents Act, 1901, August 25th, 1906, being date of application in Germany.) June 21st. (Complete.)

14,394. "Improved automatic starting and controlling device for electric motors." C. Coppock. June 22nd.

14,413. "Improved method and position of tension adjustment on electrical brush gear." T. S. S. Marshall. June 22nd.

14,426. "Testing apparatus for plug-fuses." H. Henning. June 22nd. (Complete.)

14,440. "Improvements in and relating to the control of electric motors." Allgemeine Elektricitats Ges. (Date applied for under Patents Act, 1901, June 23rd, 1906, being date of application in Germany.) June 22nd. (Complete.)

14,451. "Improvements in and connected with the production and detection of electric oscillations." W. P. Thompson. (Gesellschaft für Drahtlose Telegraphie m.b.H., Germany.) June 22nd. (Complete.)

14,461. "Improvements relating to electric motors and similar machines." J. Jackson and T. Jackson. June 22nd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1906.

Telephonic Systems and Apparatus Therefor. H. H. Lake. (Stromberg-Carlson Telephone Manufacturing Co.) 10,602. May 5th.

Storage Battery. R. B. Allen. 12,974. June 5th.

Process for Oxidising Liquids with aid of Electric Discharges. A. de Hemptinne. 13,023. June 5th.

Systems of Operating Electrically-Propelled Vehicles. British Thomson-Houston Co. (General Electric Co.) 13,287. June 8th.

Electric Motor-Generators. British Thomson-Houston Co. (General Electric Co.) 13,332. June 9th.

Reactive Coils for Use in Systems of Electric Distribution Employing Vapour-Electric Apparatus. British Thomson-Houston Co. (General Electric Co.) 13,690. June 14th.

Electric Temperature Indicator for Bearings and the like. R. W. Robson and G. W. Clegg. 15,245. July 5th.

Apparatus for Regulating the Speed of Asynchronous Electric Motors. A. Scherbius. 16,087. July 16th. (Date applied for under International Convention, July 18th, 1905.)

Electric Battery Zinc. H. Rollet. 16,159. July 17th.

Appliances for Use in Connection with the Electric Ignition Systems for Internal Combustion Engines. Electric Ignition Co. and F. H. Hall. 17,812. August 8th.

Dynamos and Motors. H. Lacy. 18,119. August 13th.

Electric Motors. H. Lacy. 18,120. August 13th.

Electric Conductors Suitable for Incandescent Lamp Filaments, Furnaces or other Apparatus. British Thomson-Houston Co. (General Electric Co.) 18,487. August 17th.

Cable Conduit for Electric Mains. V. von Pindtershofen. 19,861. September 6th.

Manufacture of Shade Holders, Shade Fittings, Lamp or Globe Holders for Lamps, Electric Lights, Gas, Candle and such like Fittings. J. Hinks & Son and S. H. Brittain. 20,490. September 15th.

Starting Switches for Use in Connection with Electro-Motors. J. Brooker. 20,580. September 17th.

Apparatus for Supplying or Controlling the Current to Electrical Igniters of Explosion Engines. A. Gibaud. 21,008. September 21st. (Date applied for under International Convention, September 22nd, 1905.)

Apparatus for Telephonic Telegraphy. R. O. P. Berglund, W. A. W. E. Hjorth and C. E. Ljungman. 22,879. October 16th.

Current Collectors for Vehicles or Trains Running on Electric Railways or Tramways with Overhead Conductors. P. Dawson. 25,198. November 8th.

Electric Fire Alarms. W. Matzka and W. Timmermann. 25,508. November 12th.

Electric Switches. K. Abel and F. Pervesler. 28,795. December 17th.

1907.

Electric Cut-Outs and the like. Akt.-Ges. Brown, Boveri & Cie. 543. January 8th. (Date applied for under International Convention, May 2nd, 1906.)

Manufacture of Incandescence Filaments for Electric Lamps from Metallic Thorium Containing Oxide with or without Admixtures of other Difficultly Fusible Metals. Siemens & Halske Akt.-Ges. 2,123. January 28th. (Date applied for under International Convention, March 29th, 1906.)

Formes or Moulds Particularly for Use in Moulding Insulating Sheaths for Electric Conductors from Sheet Fibrous Material. W. H. Baker. 2,515. January 31st. (Date applied for under International Convention, March 21st, 1906.)

Apparatus for Electrically Detecting Railway Points or the like. Siemen Bros. & Co. and L. M. G. Ferreira. 3,082. February 7th.

Electric Switches. G. McAlpine. 5,116. March 2nd.

Apparatus for Treating Minerals by Electrolysis. N. H. M. Dekker. 5,887. March 11th.

Alkali Chloride Electrolysis. — Electrochemical methods are generally employed in chemical industries for the sake of simplifying the operation. Thus in the Le Blanc, Welden, Deacon and Colvay processes a long series of operations is involved along with innumerable chemical reactions. The electric current, on the other hand, decomposes a salt in one single apparatus and in one single operation, the only necessary precaution being to separate the anodic from the cathodic products to prevent reunion. For the production of caustic alkalies from chlorides it is impossible to obtain concentrated solutions of the product economically by merely using a diaphragm, and from time to time modifications have been suggested, but only the simplest have enjoyed any commercial success. In this connection the bell process is of extreme importance, and is in use on a very large scale in both Germany and Austria. The general principle is simple and may be briefly described as follows:—An earthenware bell is suspended in a salt solution, and contains the anode inside, the cathode being placed externally. The anode liquid has a lower specific gravity than the original salt solution, which in turn is less than the caustic alkali produced at the cathode. This keeps the chlorine liquors high up in the bell, followed by neutral and unchanged salt solution and finally caustic alkali outside the bell. Fresh salt solution is run in to the anode chamber which causes the caustic alkali to escape from the outside chamber. The chlorine gas is removed from the anode compartment and the whole process is kept running automatically. Fortunately chlorine gas is only slightly soluble in salt solutions, and very little loss of caustic alkali is experienced by this means. In actually working the process, it is necessary to keep the supply of salt solution equivalent to that removed by the current, otherwise a creeping of the layers takes place. The anode is made so large that it fills almost completely the entire cross section of the bell, and must be on a dead level with the surface of the liquid. The current density employed is 2 amperes per sq. decimeter of horizontal cross section of the bell, and working in this manner an Acheson graphite anode will last for five years. In this way a very simple device is at hand for obtaining concentrated solutions of caustic alkalies, with a very high ampere-hour efficiency. The great disadvantage is that comparatively small bells have to be employed, and for large production several small sets of plant have to be set up and tended.—*Electrochemical and Metallurgical Industry*, Vol. V, No. 5.